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THIRD SERIES VOL 61 NUMBER 12 OCTOBER 1954

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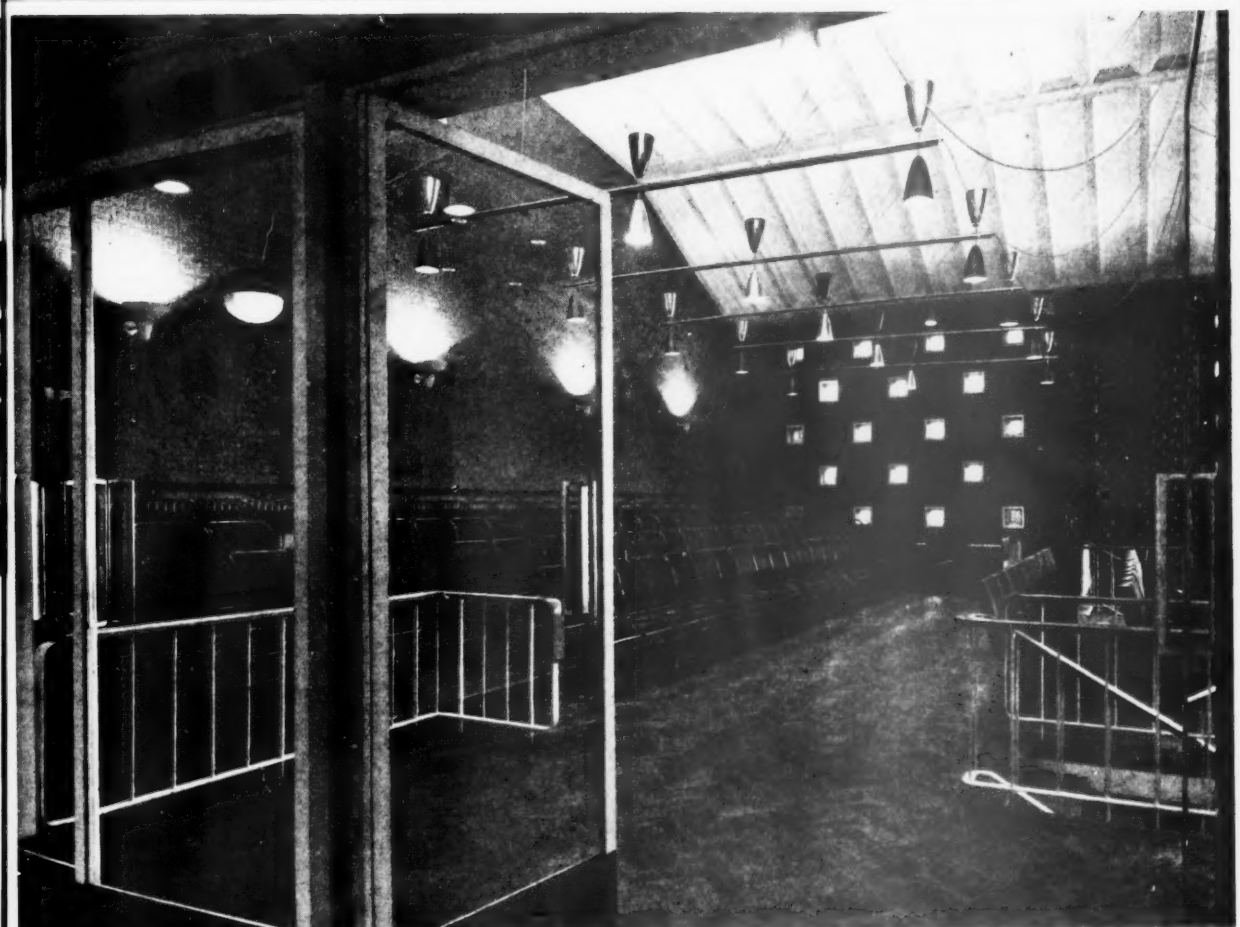

The entrance to the hall of the Thomas Linacre School, Wigan. Architects: Howard V. Lobb, C.B.E. [F] and G. Grenfell Baines and Hargreaves [A.A]

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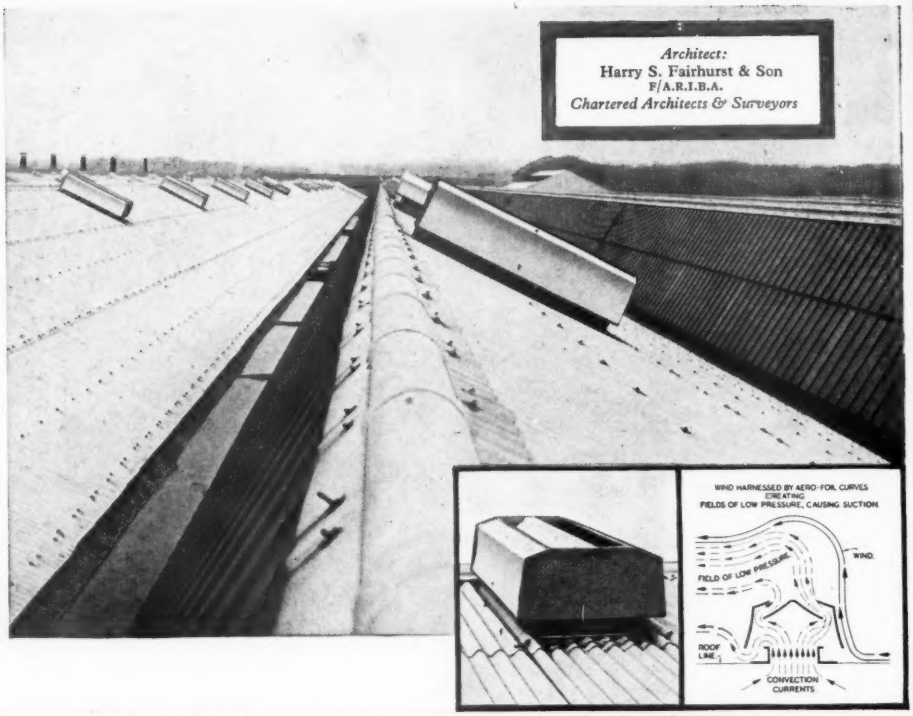

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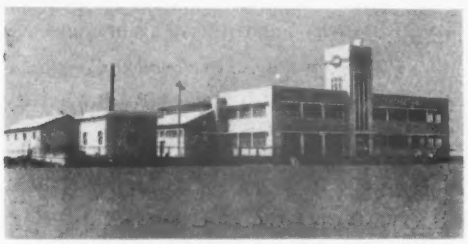

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The Glass Age Development Committee

Sixteen years ago a Committee of architects, convened by Pilkington Brothers Limited, was invited to suggest solutions to certain problems of town planning. The six illustrated reports issued by that Committee demonstrated what could be done in London and other cities by using all the structural and decorative resources of the glass age, but presenting practical schemes that could actually be built.

Since 1938 and 1939, when those reports were published as advertisements in the architectural journals, great changes have occurred and others are foreshadowed: new ideas about the layout of cities have arisen, new materials and techniques to facilitate their expression have been invented, road traffic has increased to an almost unmanageable volume, and new forms of traffic — the helicopter for example — are posing fresh problems. The cities and countryside of Britain must obviously change greatly before the year 2000 — changes for the better could be made now; and in anticipation of such changes and to stimulate thought about them, Pilkington Brothers Limited have again convened a Committee of architects and engineers.

This Glass Age Development Committee consists of:

G. A. Jellicoe, F.R.I.B.A., Edward D. Mills, F.R.I.B.A., Ove Arup & Partners

THE FIRST PROJECT — SOHO

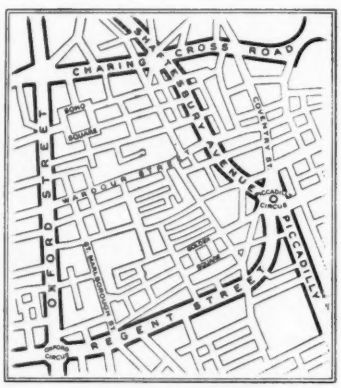
1 Preliminary Survey

The Committee's first project is the Soho area, potentially one of the most economically fruitful areas in London. It is bounded northwards by Oxford Street, eastwards by Charing Cross Road, to the south by Shaftesbury Avenue, with Regent Street on the west.

A preliminary survey of the project occupies these two pages, and the proposals made are for the development of the Soho area as a whole, up to its full economic capacity, with the following reservations:

a *The perimeter shops and theatres are to be retained in their present use.*

b *The existing personal character of Soho, in principle if not in detail, is to be preserved.*



These are the main development proposals:

i *To create a great weather-protected and air-conditioned shopping and office precinct, free of traffic but accessible for goods, private cars, helicopters, and existing public communications.*

ii *To create six 24-storey blocks of good-class residential flats.*

iii *To create a spacious open-air entertainment centre, as a supplement to existing indoor entertainment facilities.*

All the proposals made for this project are practical possibilities.

The techniques and materials to execute them exist now.

Their detailed application will be published in further reports.

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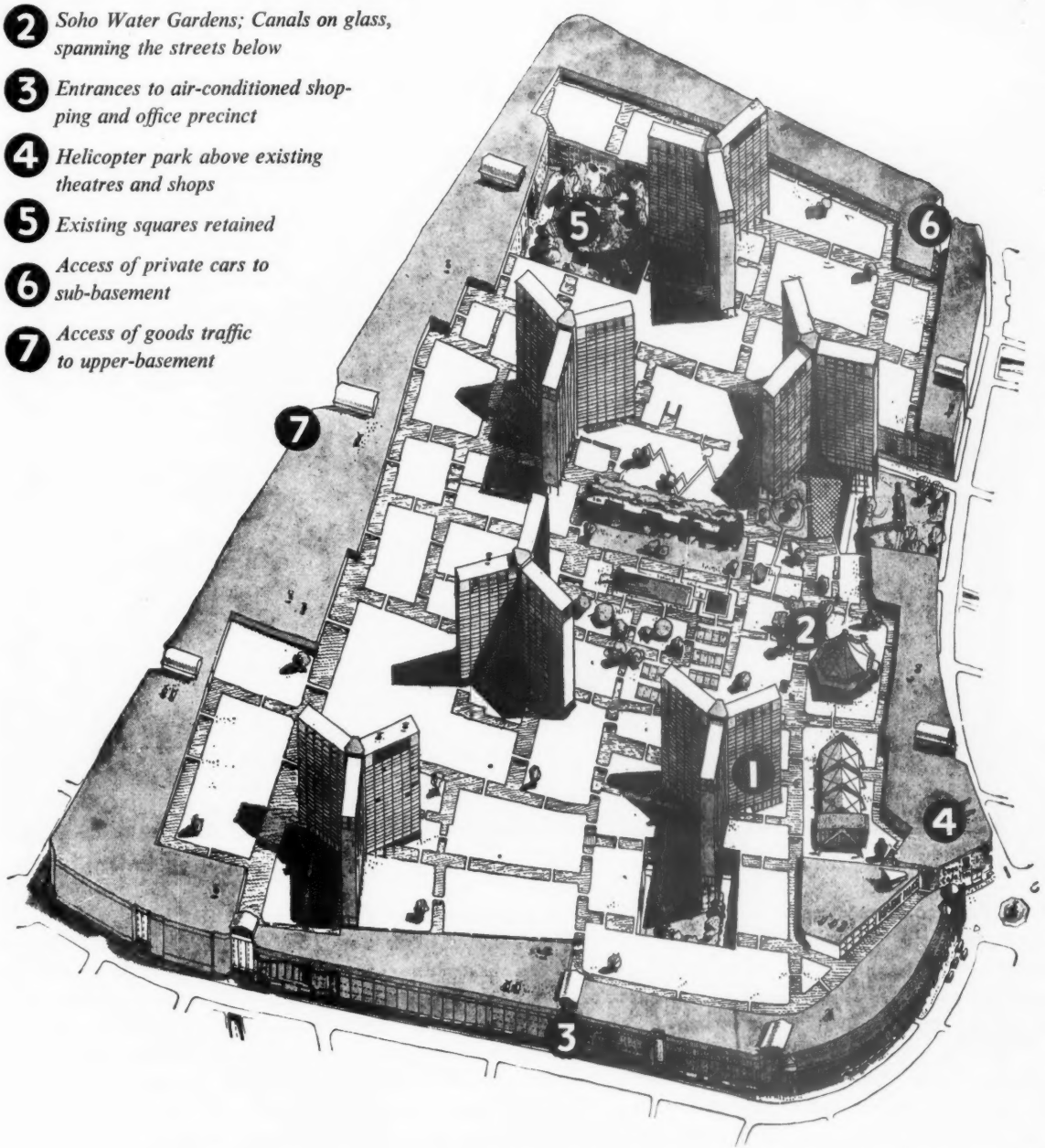
1. *24-storey blocks of flats, helicopter garages above, restaurants on Soho Gardens level*
2. *Soho Water Gardens; Canals on glass, spanning the streets below*
3. *Entrances to air-conditioned shopping and office precinct*
4. *Helicopter park above existing theatres and shops*
5. *Existing squares retained*
6. *Access of private cars to sub-basement*
7. *Access of goods traffic to upper-basement*



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The completed work is also an outstanding instance of the advantages to architects and contractors of using the services of firms who are members of the Patent Glazing Conference. Sixty tons of aluminium were needed for the glazing for the hangar roof. When the contract was placed supplies of aluminium to all patent glazing manufacturers were in short supply because of the demands of aircraft manufacturers engaged on the defence programme. This difficulty - and others which such a large-scale piece of construction presents - were overcome by two members of the Patent Glazing Conference collaborating on the contract and working closely together to make the erection of the roof a combined operation.

Architect and engineer: Sir Owen Williams and Partners. Main contractors: Messrs. W. & C. French Ltd.

SPECIFICATIONS

LONDON AIRPORT

A close-up view showing the glazing and supporting structure from underneath.

A general view of the interior of one of the hangars.

For all facts about patent glazing, write to the Information Bureau, the Patent Glazing Conference, Burwood House, Caxton Street, London, S.W.1.

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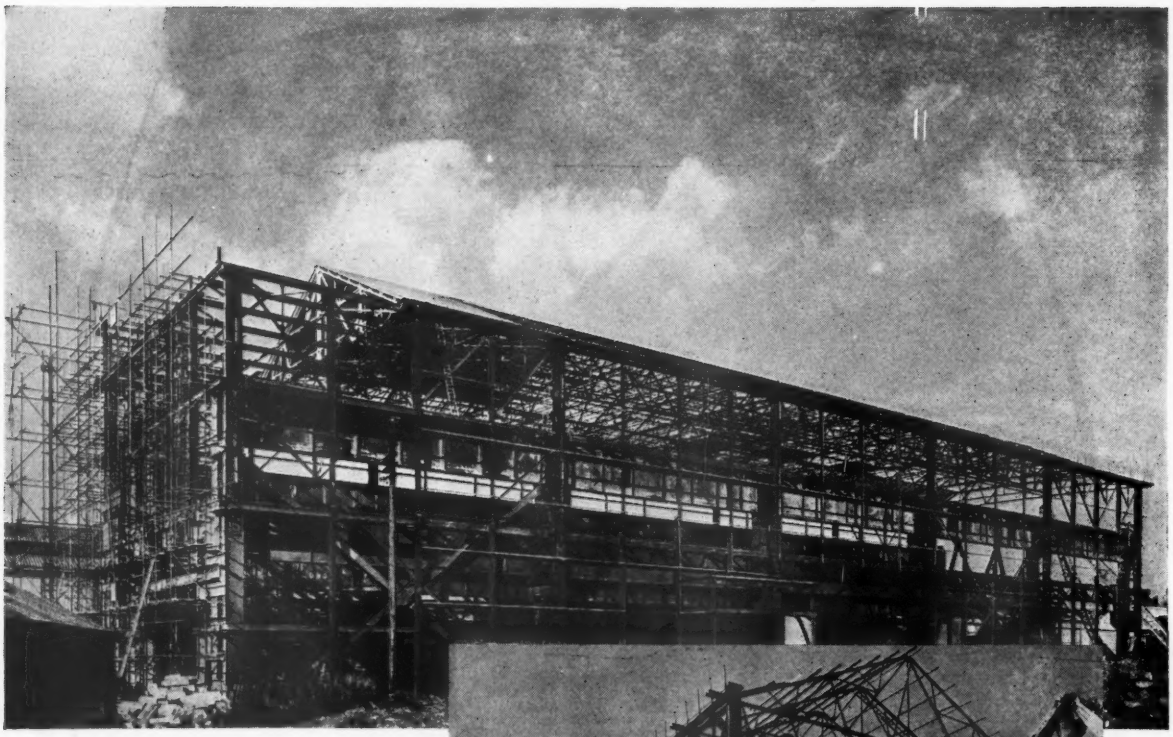

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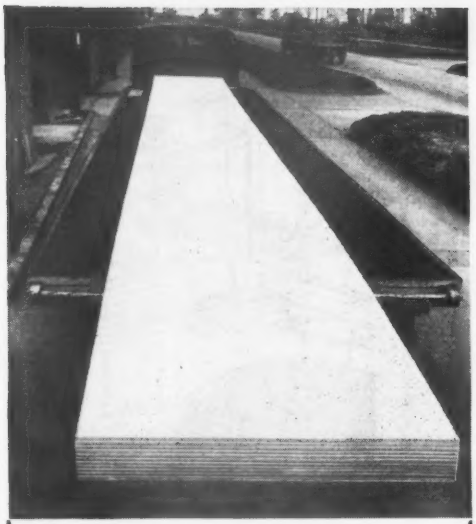

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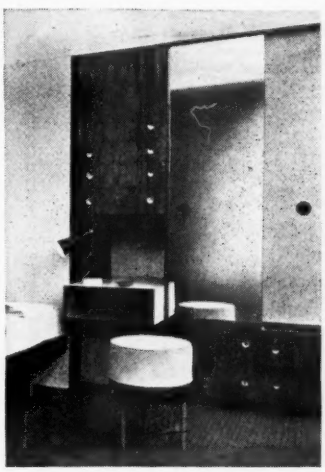

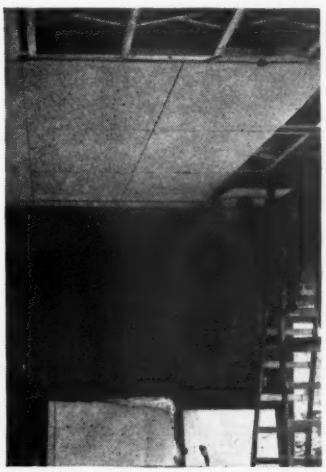

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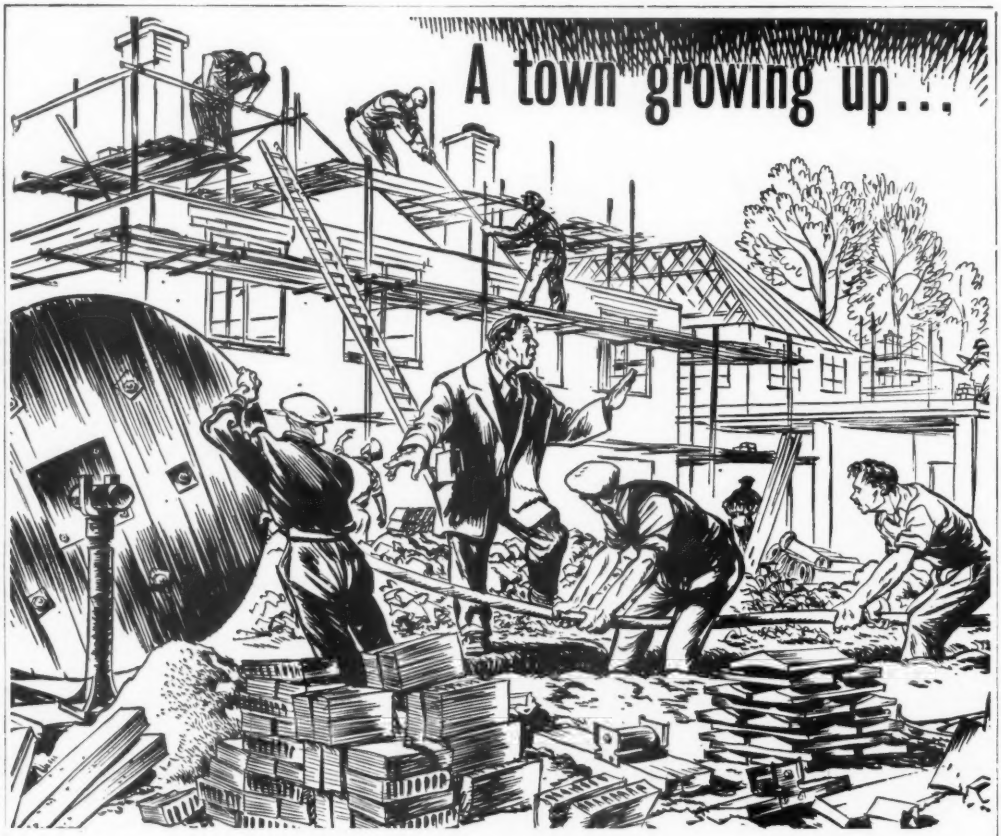

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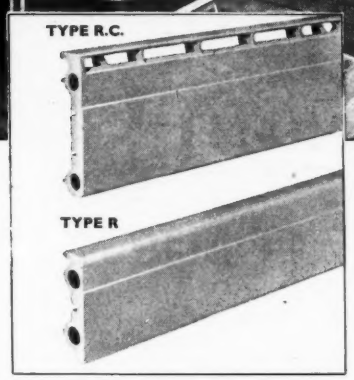

The main illustration shows both types of Crane Skirting Heating installed. The 9″ type 'RC' is particularly suitable for use under large windows with low sills. Also for public buildings such as libraries and art galleries, etc. Manufactured in 2′ lengths only. The 6″ type 'R'—for flats and houses—is also manufactured in 2′ lengths. On walls where heating is not required, matching wood skirting can easily be included for continuity. Both types are normally delivered unassembled unless otherwise instructed. Standard pipe connections ¾″—both types. Crane Skirting Heating is primarily designed for inclusion in buildings in the course of construction, but can also be installed in existing property.

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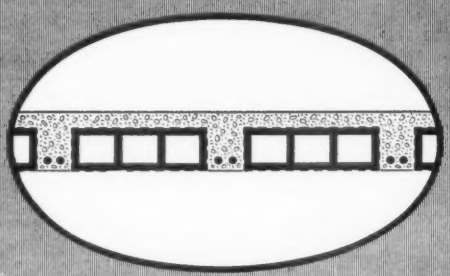

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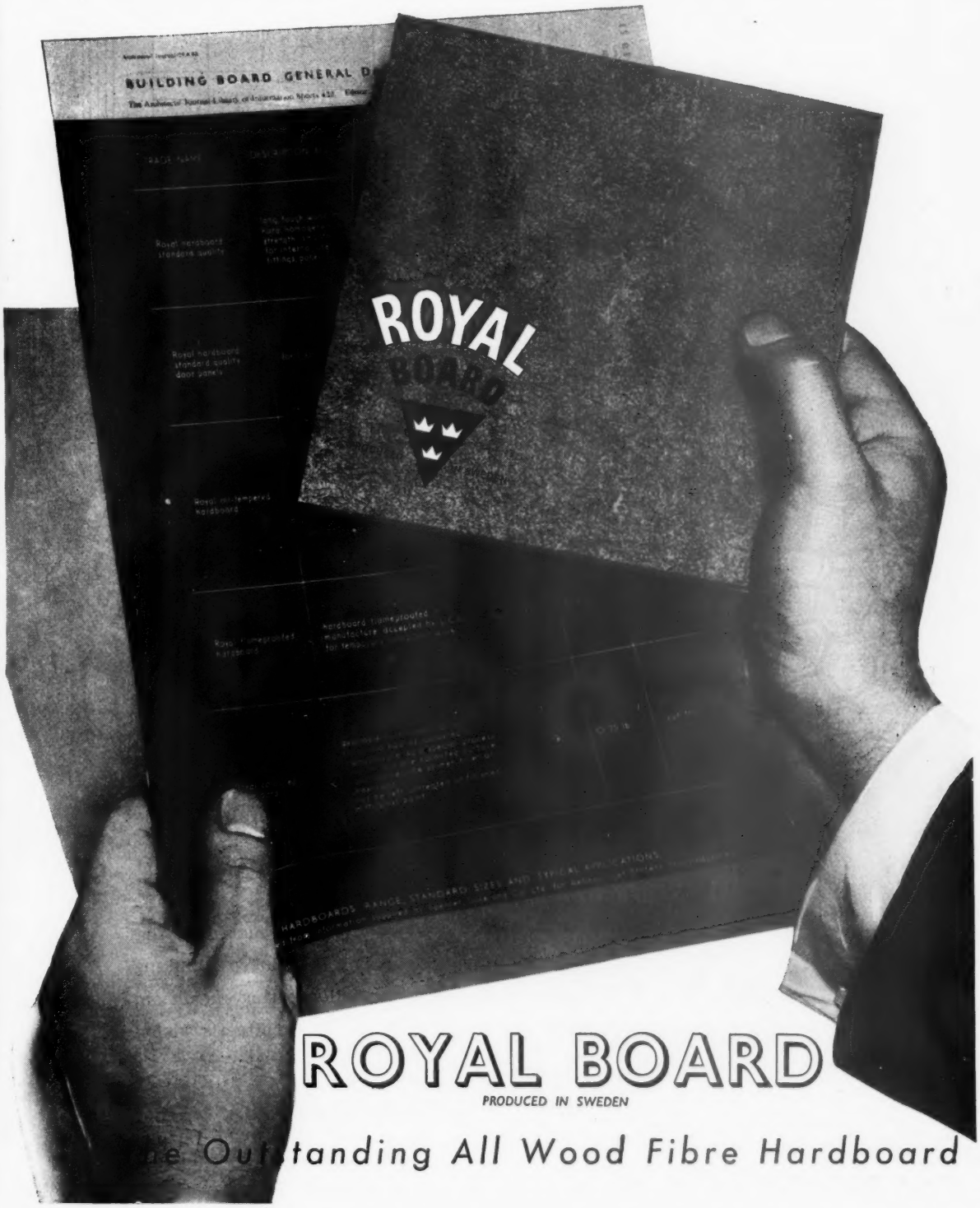

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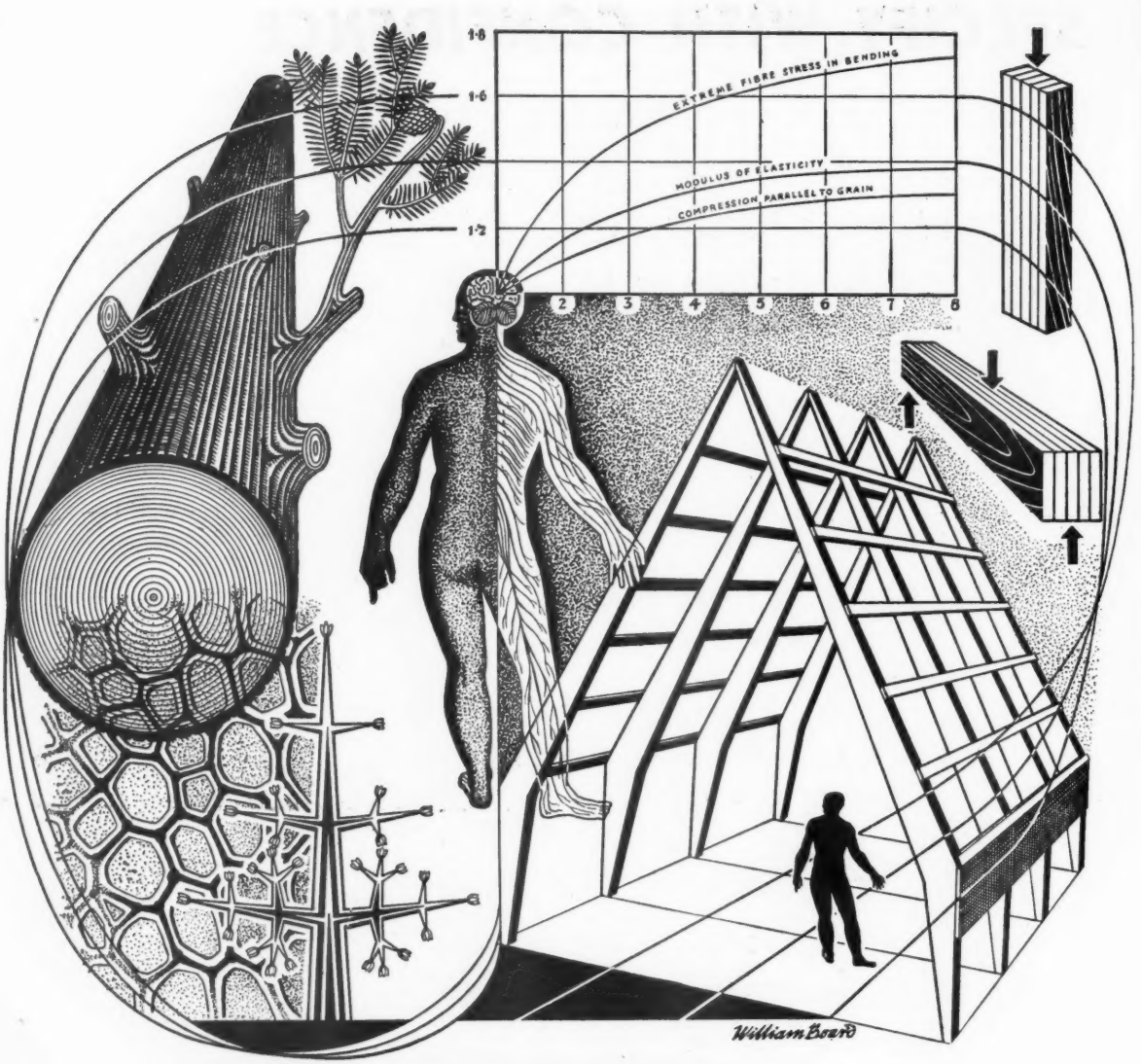

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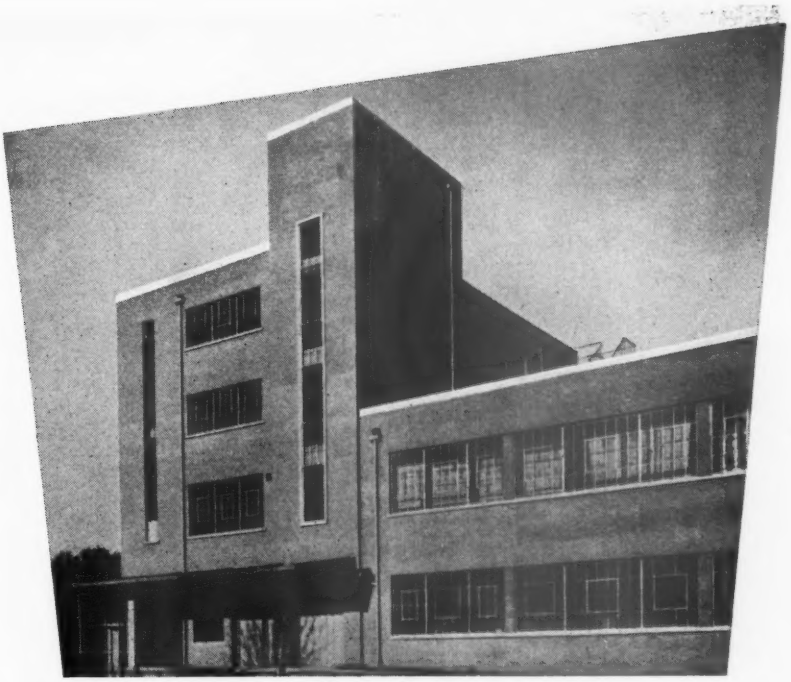

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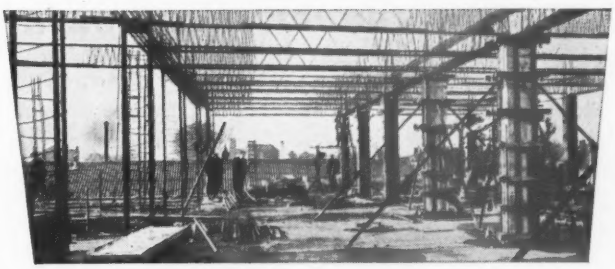

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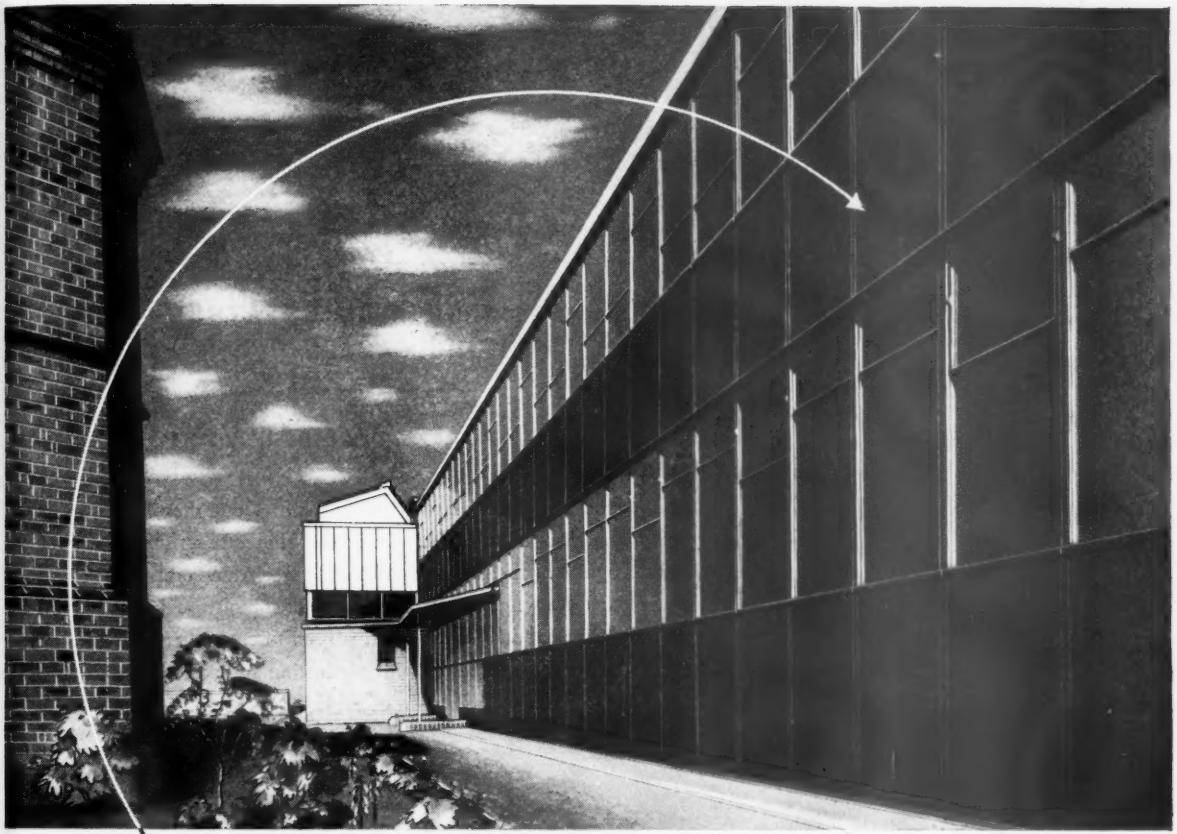

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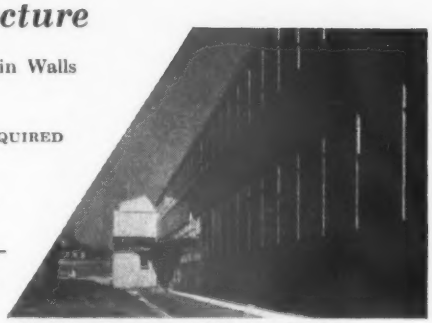
The illustrations show 'HOLOPLAST' cavitied panels used as a curtain wall for the Technical College built for the Kent County Council at Folkestone. In this project the panels chosen are of terracotta colour, with a hammered finish.

Other Holoplast products include 'Decorplast' and 'Corroplast'

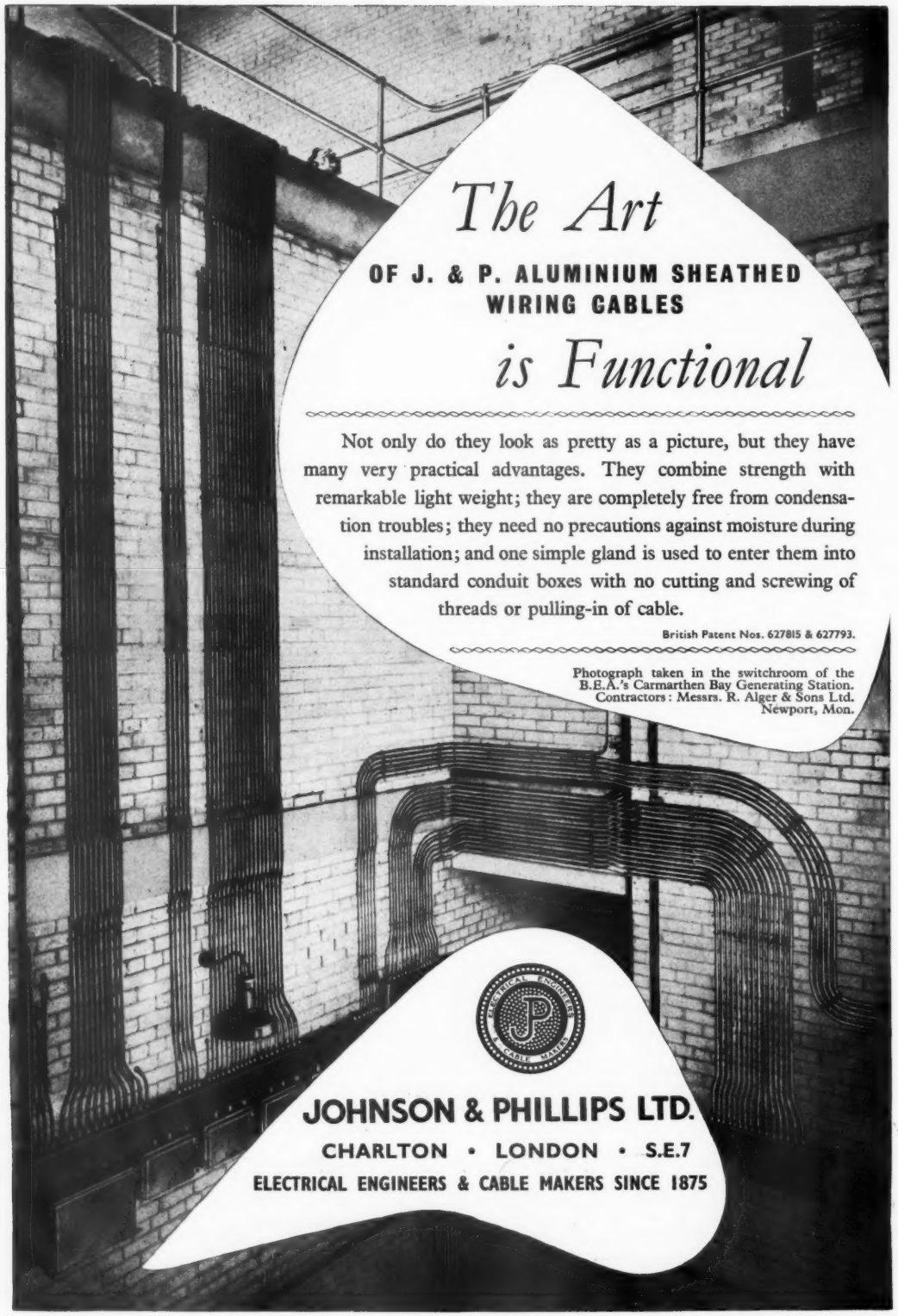


COUNTY ARCHITECT: S. H. LOWETH, F.S.A., F.R.I.B.A.
ASSISTANT ARCHITECT IN CHARGE: J. CARNHAM WRIGHT, A.R.I.B.A.
CONTRACTORS: O. MARX & SONS LTD.

'HOLOPLAST'

HOLOPLAST LIMITED *SALES OFFICE:* 116 VICTORIA STREET, LONDON, S.W.1 *TELEPHONE:* VICTORIA 9354-7 & 9981
HEAD OFFICE & WORKS: NEW HYTHE, NEAR MAIDSTONE, KENT

DOWNTONS *Advertising*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Not only do they look as pretty as a picture, but they have many very practical advantages. They combine strength with remarkable light weight; they are completely free from condensation troubles; they need no precautions against moisture during installation; and one simple gland is used to enter them into standard conduit boxes with no cutting and screwing of threads or pulling-in of cable.
British Patent Nos. 627815 & 627793.
Photograph taken in the switchroom of the B.E.A.'s Carmarthen Bay Generating Station. Contractors: Messrs. R. Alger & Sons Ltd. Newport, Mon.
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ROBERTSON Q-Floor meets the demand for speed of erection in both single and multi-storey construction. Once in position it also provides a working platform for other trades.

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QFL. 304

copying

To claim that copying costs come down with AZOFLEX is a bold statement — but one that happens to be very true. AZOFLEX photo-printing machines and materials provide the ideal means of producing inexpensive, high-quality facsimiles of drawn, typed or printed originals of all kinds — single or double-sided, translucent or opaque. Many important industrial, commercial and professional organizations have already proved the economy and effectiveness of the AZOFLEX process.

costs

The simplicity and cheapness of AZOFLEX are quite startling. With the Model 42/63 Mark II Combined Printing and Developing Machine illustrated here, for example, one *unskilled* operator need only feed originals and copying material into the machine in order to produce a steady output of finished prints, dried, flat and ready for trimming and collating. Exposing, developing and print delivery are completely synchronized.

come

With the AZOFLEX method, money is saved because not only does it eliminate the need for specialist operators, but neither darkroom accommodation nor water and drainage services are required, and the materials themselves are inexpensive. AZOFLEX also cuts costs by speeding up output and by giving copies of greatly improved quality even from poor originals.

down

There is a comprehensive range of AZOFLEX printing and developing machines and a wide variety of AZOFLEX photo-printing materials designed to meet the needs of every type of organization. AZOFLEX creates no mess or unpleasant smell, while the materials are very easy to handle and process.

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For descriptive literature about AZOFLEX machines and materials, please apply to Ilford Limited, Azoflex Department AZ3J, 104 High Holborn, London, W.C.1 (Telephone : HOLborn 3401). Demonstrations of the Azoflex process can be seen at this address and also, by appointment, at Ilford Limited, 22 Lloyd Street, Manchester 2 (Telephone : Deansgate 4233) and in other principal cities.

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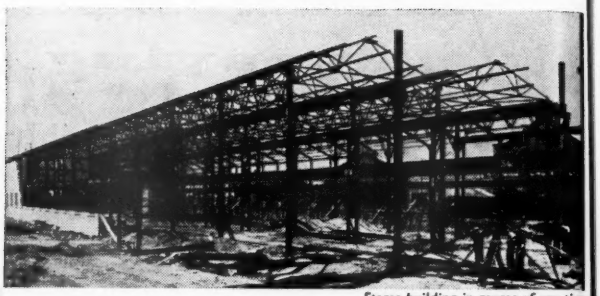
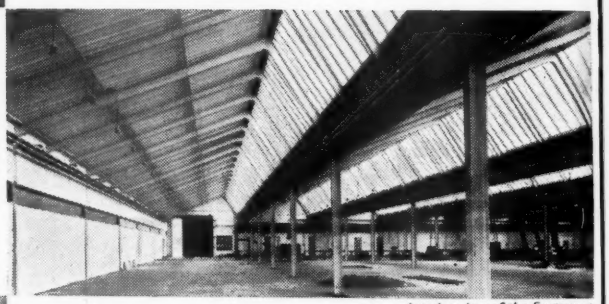


Stores building in course of erection for National Gas & Oil Engines Limited.

Extension to Factory—
Messrs. F. E. Fox & Son Limited, Batley. Biscuit Manufacturers.
Architects: Smith & Curry, Heckmondwike.

Multi-storey

Welded or...



Interior view of the Factory at Barnsley, Messrs. Brook Motors Ltd.

Birlec Ltd., Birmingham. Stores Building.

Riveted

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TRADE MARK VULCAN
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'Expamet' Expanded Steel being used as a reinforcement for concrete in the construction of the Trelleck Reservoir for the Monmouth Rural District Council.
CIVIL ENGINEERS: *Thomas & Morgan & Partners, Pontypridd, Glam.*
CONTRACTORS: *Norwest Construction Co. Ltd., Litherland, Liverpool.*

Concrete reinforcement with 'Expamet' Expanded Steel in reservoir construction

HERE you see a typical application of "Expamet" Expanded Steel — as reinforcement for concrete. "Expamet" Expanded Steel is the unique reinforcement that affords the highest degree of grip and bond in concrete. The shape of the meshes also assists in "distribution" of point or concentrated loads, and in preventing cracking of concrete due to shrinkage and changes of temperature.

A 'tailor-made' reinforcement

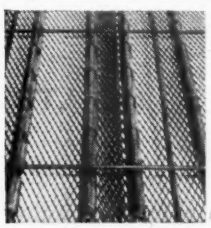
This adaptable reinforcement is produced in a very large number of standard sectional areas; the weight of fabric varying from 2 lbs. to over 30 lbs. per square yard. Sheets can be supplied cut to size — thus eliminating waste and loss of time. "Expamet" is indeed a 'Tailor-made' reinforcement.

What's your problem?

We will gladly submit designs and estimates for the reinforcement of all forms of concrete construction. Let us know what application for "Expamet" you have in mind. Literature and samples will be sent on application. Please write or telephone.

Super RIBMET

Super "Ribmet" is shuttering and reinforcement combined.



By its use, the advantages of monolithic construction are obtained in the construction of concrete floors, roofs and similar decking, without the expenses of preparing, erecting and dismantling close boarded shuttering. Standard sizes are 3′ 0″ wide (short way of mesh) by 4′ 0″ to 15′ 6″ long inclusive, rising by 6″ at a time.

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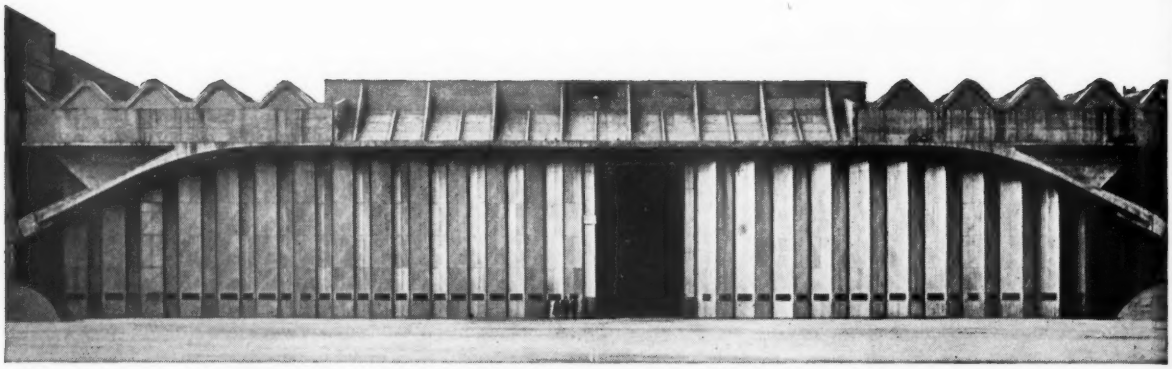

'Rigidal' Mansard Sheeting

for the 'Templex' Hangar Doors at London Airport

Each leaf, 46ft. high and 6ft. wide, is clad on both sides with 'Rigidal' Mansard sheeting. There are 224 of these leaves to each set of doors and the door opening is 46ft. high and 300ft. wide. Four new hangars for B.O.A.C. will be equipped with similar folding and sliding doors.

Doors constructed and erected by
Head Wrightson Aluminium Limited,
Thornaby-on-Tees, to the design by
Mr. J. E. Temple, Whit.Sch.D.I.C., for the
Ministry of Transport and Civil Aviation
Main Contractors:
W. & C. French Ltd., Buckhurst Hill, Essex
Engineers and Architects:
Sir Owen Williams & Partners

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PLIMBERITE FOR ROOF CONSTRUCTION

specified by
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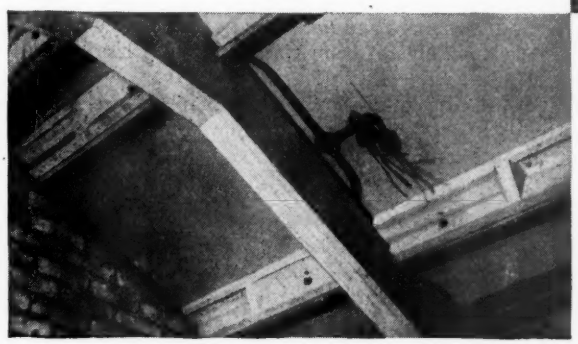
(MIDLANDS DIVISION)

TEMPORARY OFFICE ACCOMMODATION
Wake Green Road, Moseley, Birmingham, 13

¾" PLIMBERITE boards were supported on purlins at 3' 2" centres and covered with mineralised roofing felt. This use of PLIMBERITE provides a solid, permanent roof quickly constructed with minimum labour, the 8' x 4' boards being laid in position and bolted. Electrical fittings are easily fixed with ordinary screws.



PLIMBERITE is a versatile wood chipboard possessing the general characteristics of natural timber. Manufactured in 8' x 4' boards in thicknesses of ½" and ¾", it is used extensively for partitions, floors, walls, roofs, etc. For full details refer to your standard reference books or write to the manufacturers for illustrated technical literature.

from floor to ceiling, from wall to wall

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Insulating GYPROC *WALLBOARD*

AND

Insulating GYPROC *LATH*

FOR

THERMAL INSULATION AND FIRE PROTECTION

These are standard GYPROC products with a thin sheet of *polished aluminium foil* firmly bonded to one side, giving laminated materials that combine the valuable heat reflecting properties of aluminium foil with the fire resistance properties of gypsum plaster-board.

THERMAL INSULATION

The thermal conductance of *Insulating* GYPROC Wallboard and *Insulating* GYPROC Lath (including 1" cavity) is 0.42 B.Th.U./sq.ft./hr./°F. difference in temperature. The materials are fixed with the metal foil side against the framing members, which should be of sufficient thickness to provide an air space of not less than ¾" to ensure that the maximum heat insulation efficiency is obtained.

FIRE RESISTANCE

Insulating GYPROC Wallboard and *Insulating* GYPROC Lath possess "surfaces of very low flame spread," being classified in the Class I Group for Surface Spread of Flame — British Standard 476. The gypsum core of these materials resists the penetration of fire until the hydrated character is completely destroyed and the aluminium foil adds to the fire resistance by retarding the escape of water vapour from the core.

***Insulating* GYPROC Wallboard** is supplied in standard sizes of dimensions 3 ft. and 4 ft. wide; 6 ft. – 12 ft. in length, and ⅜ in. and ½ in. thick. It is available with square edges or recessed edges, the latter to ensure flush jointing. The unfoiled surface presents an excellent interior wall or surface finish for direct decoration.

***Insulating* GYPROC Lath** is supplied in standard sizes of dimension 16 ins. wide and ⅜ in. thick, in lengths 32 ins., 42 ins., 45 ins., 48 ins. and 54 ins. The unfoiled surface presents a perfect base for PARISTONE Browning Plaster, or GYPSTONE Board Finishing Plaster.

Makers of PARISTONE *Browning Plaster (Haired, Unhaired and Metal Lathing Grades),* PARISTONE *Wall Finishing Plaster,* CRETESTONE *Concrete Bonding Plaster,* GYPSTONE *Board Finishing Plaster,* GYPLITE *Vermiculite Insulating Plaster (Undercoat and Finishing Grades).*

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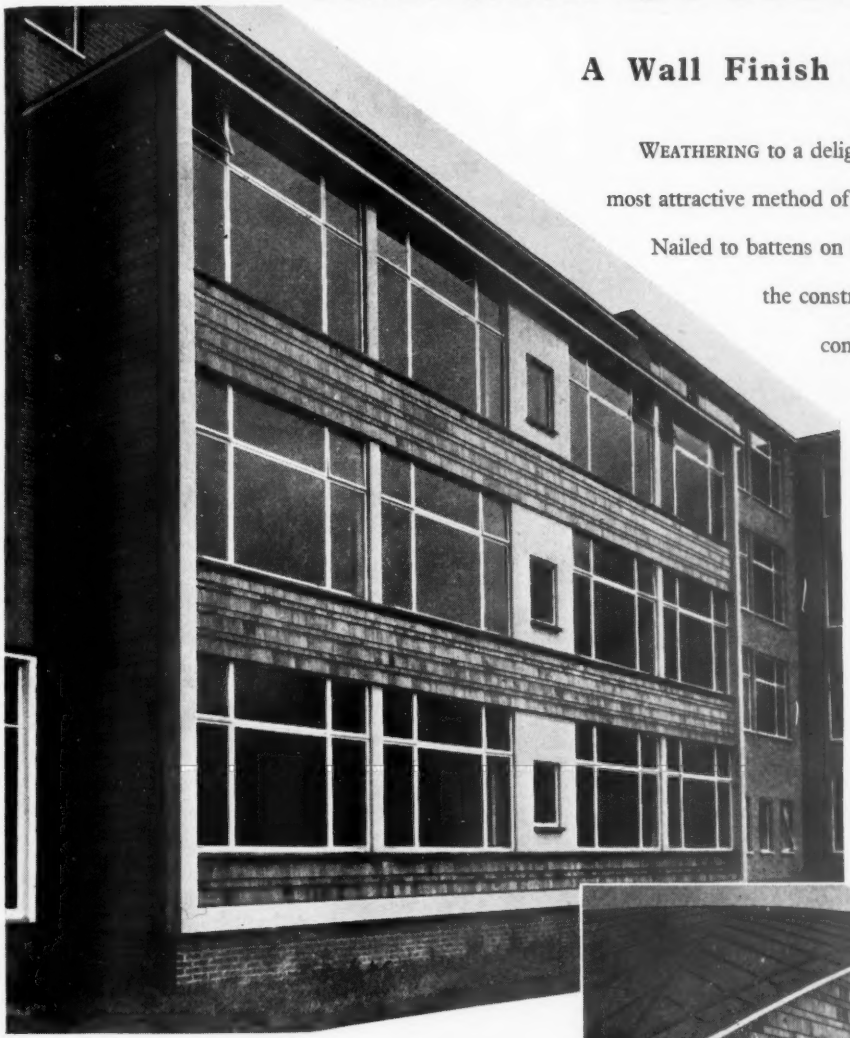
IW. 1

COLT *Canadian Cedar Wood* SHINGLES



A Wall Finish with a difference

WEATHERING to a delightful silvery grey, Shingles are a most attractive method of providing a distinctive elevation. Nailed to battens on brick, breeze or timber studding, the construction is most economical and is completely weatherproof. The high thermal insulation value of Western Red Cedar helps in keeping the building warm in winter and cool in summer.

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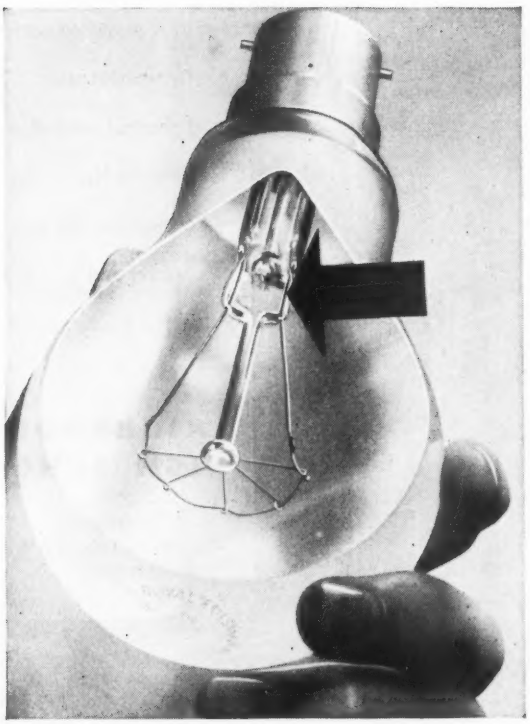

COPPER CLAD

To secure a gas tight seal at the point where the lead wires pass through the glass envelope of Royal "Ediswan" Lamps a special wire known as Copper Clad is used. This seal must remain gas tight over the range of temperature from cold to the highest value which the lamp attains when alight.

Copper Clad, made by a very specialised technique, consists of two metals hermetically bonded in such proportions that they will expand and contract at the same rate as the glass. This property together with the specially prepared surface, ensures that a perfect metal-to-glass seal is made.

**This is but one example of the intricate operations in the manufacture of Royal "Ediswan" Lamps, calling for the highest degree of technical skill and the utmost care and precision.* Nothing is left to chance — *only the finest materials are used and there is strict control at each stage of manufacture.*

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ROYAL "EDISWAN" LAMPS

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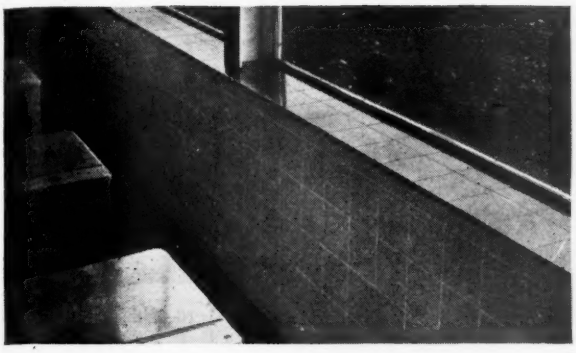

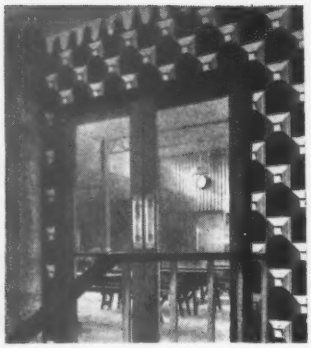

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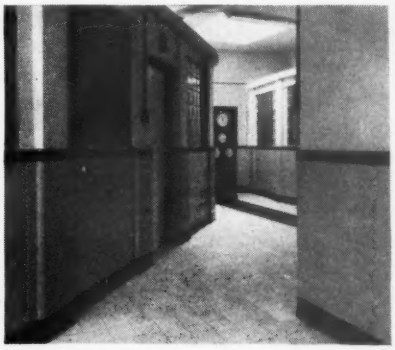

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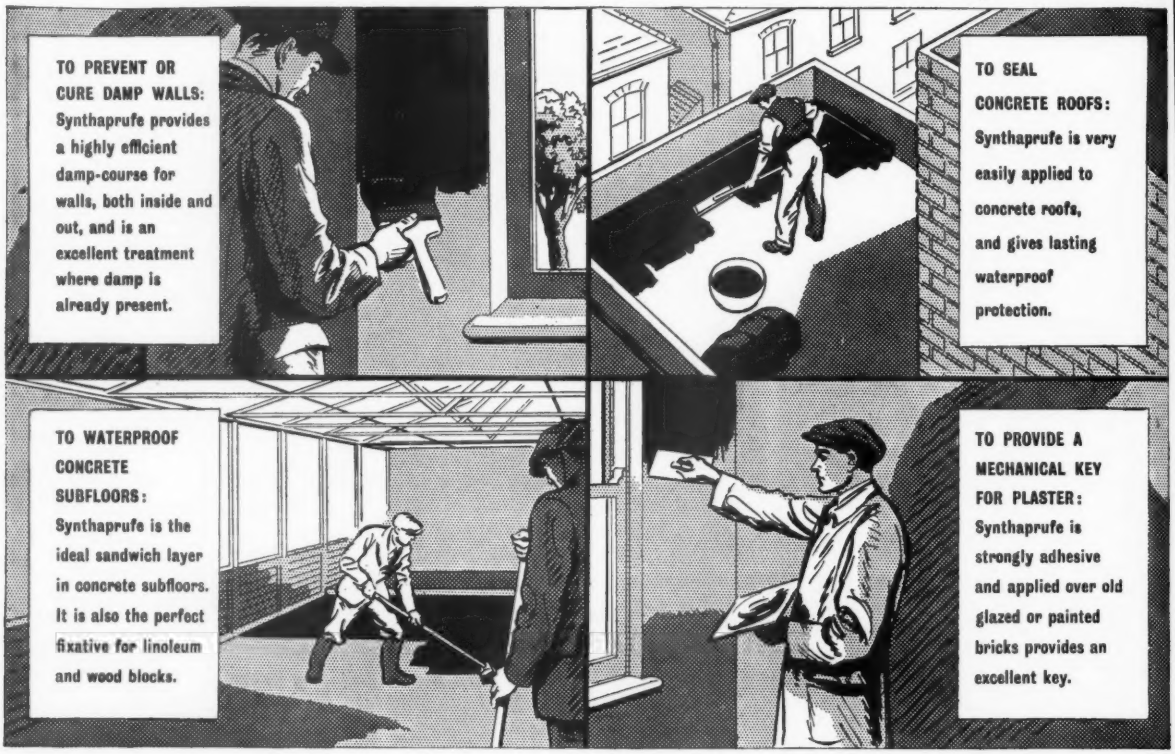
TO PREVENT OR CURE DAMP WALLS: Synthaprufe provides a highly efficient damp-course for walls, both inside and out, and is an excellent treatment where damp is already present.
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SYNTHAPRUFE is a waterproofing compound which can be applied cold by brush; its rubber content makes it strongly adhesive, and it sets quickly and forms a strong, elastic, moisture-proof film.

Most surfaces will take Synthaprufe — concrete, plaster, brick, metal or timber — and it is equally effective on old or new buildings.

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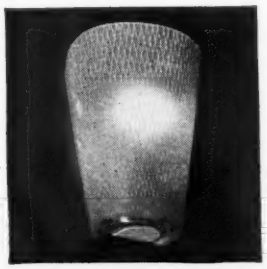
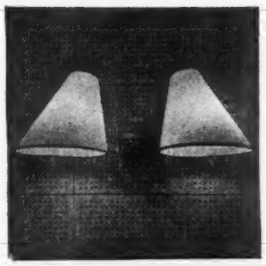
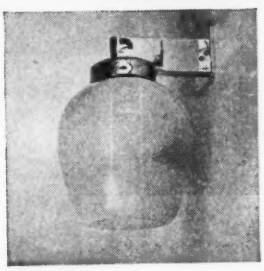
SYNTHAPRUFE

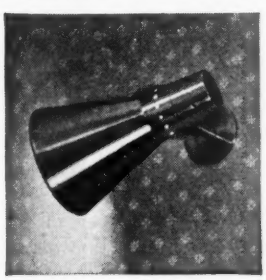
Manufactured by the NCB *National Coal Board*

Synthaprufe is a product of British Coal. Further details, and advice on any technical problem, will gladly be given on application to the National Coal Board, By Products, National Provincial Bank Buildings, Docks, Cardiff.









Wall Brackets

These are a few of the many brackets readily available from our standard ranges; in most instances there is a choice of shade assemblies and there are, of course, a variety of ceiling and pendant fittings which can be used in conjunction with these when desired.

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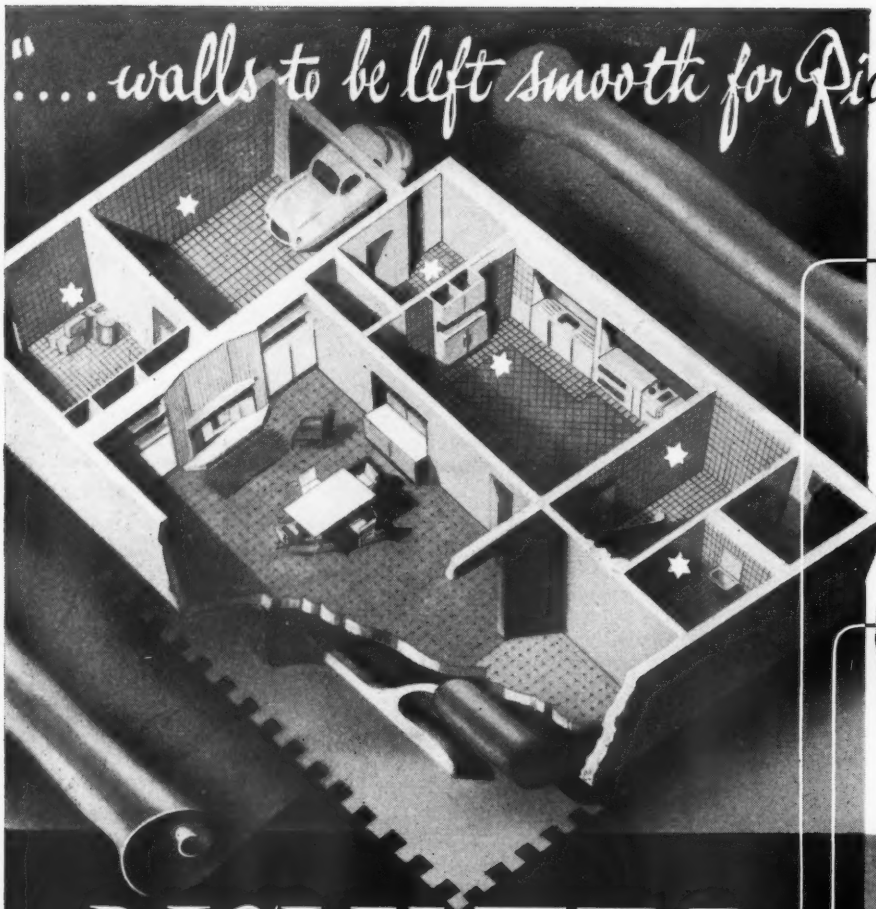
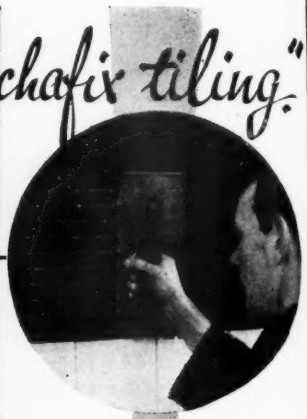
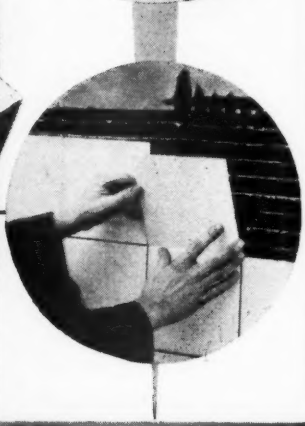
"....walls to be left smooth for Richafix tiling."







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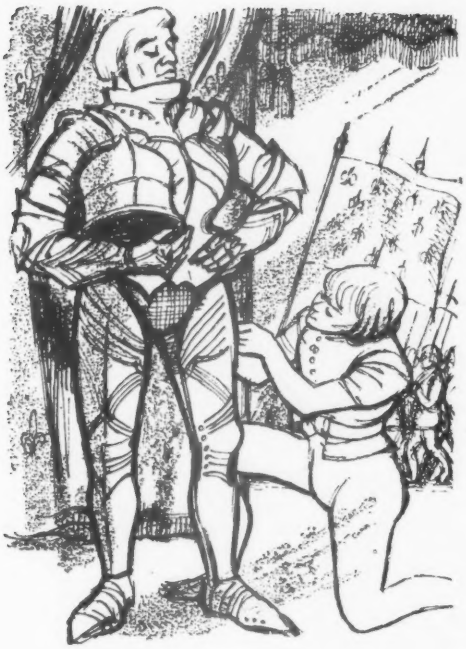

A FRENCH KNIGHT, SHEATHING HIMSELF in armour on the Eve of St. Crispin, 1415, could be excused a feeling of supreme confidence. Arrayed against the mighty army of his master, the Constable, was a small band of sick and fatigued men, the English. As he called his page to him he, no doubt, hummed a gay tune.

First he slipped on the hauberk of chain mail, next the breastplate and then the taces of overlapping mail which formed a shirt. Coudes, rerebraces, vambraces and gauntlets guarded his arms and hands, cuisses, jambs and sollerets his legs and feet. With his steel helm firmly in place he was a man of iron—impregnable . . . or so he thought.

A few hours later he galloped down upon the thin line of English archers, but of his company of 1,200 knights but seven score reached the enemy and only three penetrated the spiked barrier the archers had erected. As night fell on what was forever to be known as the battle of Agincourt, 10,000 French lay dead, a host which included 13 earls, 92 barons and 1,500 knights.

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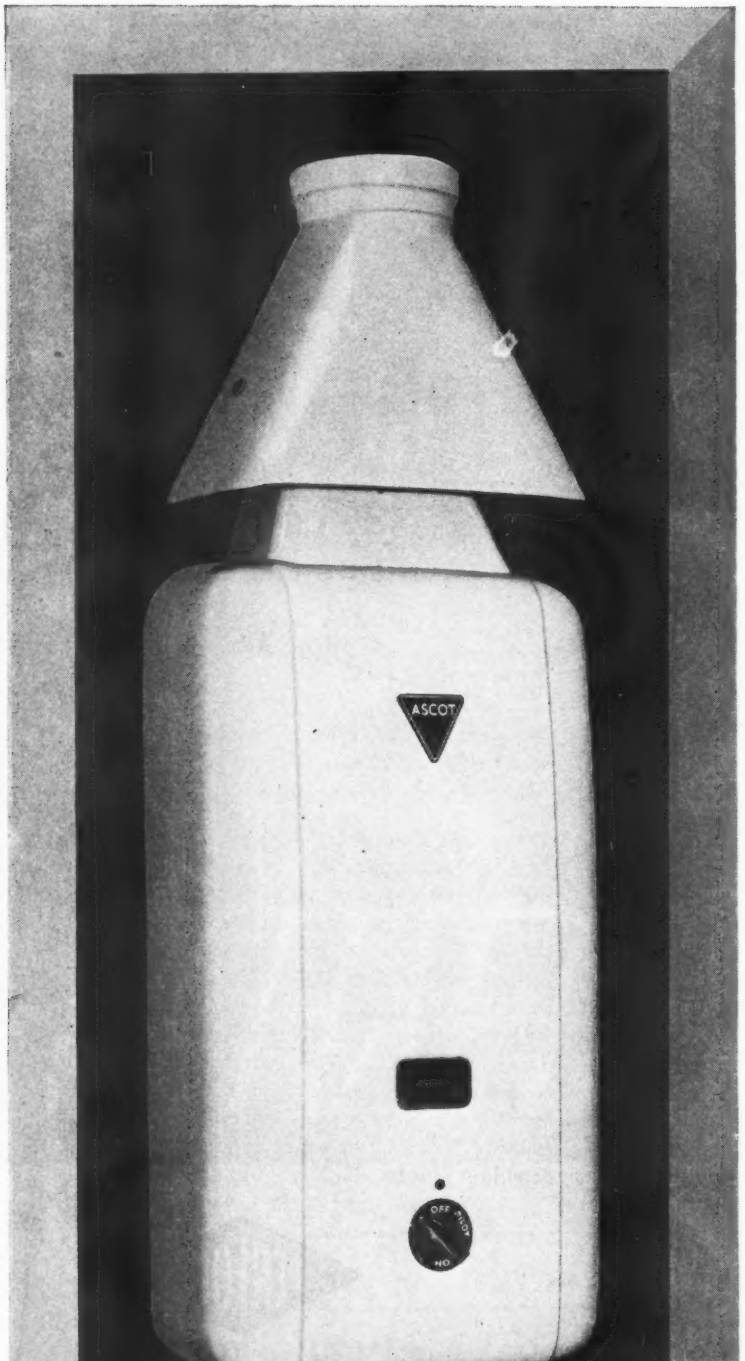

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An advantage that fitters will appreciate is that removal of the one-piece case gives free access to all parts of the heating body.

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THIRD SERIES VOLUME SIXTY-ONE NUMBER TWELVE TWO SHILLINGS AND SIXPENCE
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OCTOBER 1954

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The Inaugural Meeting

Members are reminded that the President, Mr. C. H. Aslin, C.B.E., is to deliver his Inaugural Address on Tuesday 2 November at 6 p.m. He is also to unveil the portrait of his predecessor, Sir Howard Robertson, and to present the London Architecture Bronze Medal to Messrs. A. H. Devereux and E. L. W. Davies in respect of the new out-patients' building, St. James' Hospital, Balham, which is illustrated in this JOURNAL.

Christmas Holiday Lectures for Boys and Girls

Two informal lectures for boys and girls will be given during the Christmas holidays by Mr. Basil Spence, O.B.E., A.R.A., A.R.S.A. [*F*]. The subject of the lectures will be *Coventry Cathedral: The Birth and Growth of the Idea*. They will be illustrated by lantern slides and followed by questions and discussion.

The first lecture will show how the planning of a modern cathedral is really a matter of tradition and how all our traditional buildings were modern when they were first designed. Durham and Gloucester with its great east window, Ravenna and Albi were all buildings of their own time. The new Coventry Cathedral conforms to this tradition of church building and like the old cathedrals is based on the temple plan. The lecture ends with a description of the competition for the cathedral.

The second lecture will explain in detail the design of Coventry Cathedral and point out the meaning of all the different parts of the plan—the Guild Chapel, the Chapel of Unity, the great west screen, the stained glass windows and the tapestry rising behind the altar.

The lectures are for boys and girls of 13 years of age and upwards and are to be given at the R.I.B.A. at 3 p.m. on Friday 31 December and Monday 3 January. Tickets for both or either of the lectures may be obtained free on application to the Secretary, R.I.B.A. Envelopes should be marked 'Christmas Holiday Lectures' in the top left-hand corner. Owing to the limited space available, it is requested that applications should not be made for more tickets than can be used.

British Architects' Conference 1955 at Harrogate

Owing to circumstances outside the control of the Royal Institute and the West Yorkshire Society of Architects it has been necessary to alter the date of the Conference in 1955, which had been fixed for 22–25 June. The revised date is Wednesday 8 June to Saturday 11 June inclusive.

The R.I.B.A. Window Boxes

The Gardens Section of the St. Marylebone Society hold an annual gardens competition, entries being grouped into three sections; amateur gardeners, business houses, and squares and communal gardens. Under the business houses section the R.I.B.A. has been awarded a certificate of merit for the display in the window boxes, and on 22 September the certificate was handed to a representative of the Institute by Councillor Major R. C. Orpen, J.P., A.C.A., Mayor of St. Marylebone and President of the Society. There were 17 other certificates of merit awarded in this section, as well as a first prize of a silver rose bowl.

The York Guild of Building

A Guild of Building is being formed in the City of York. Its purpose is to bring together all those in the city concerned in the building industry. Its objects are 'the advancement of design, management, science and craft in building and the encouragement of a better understanding of the problems and achievements of those engaged in building.' These objects are to be furthered by a suitable annual programme of lectures, visits, debates and social functions, competitions and the issue of publications.

The decision to form the Guild was taken at a meeting held last February which was attended by York members of the R.I.B.A., the York Building Trades Employers' Association, the National Federation of Building Trades Operatives and the York quantity surveyors. The President is Mr. P. M. Shepherd, a builder; the Vice-President is Mr. Colin Rowntree [*F*], the Hon. Treasurer is Mr. D. B. Holman, a quantity surveyor; the Hon. Secretary is Mr. David Leckenby [*A*].

The inaugural meeting, which will be limited to members and official guests, is to be held at St. William's College on 27 October when the principal speaker will be Mr. D. E. Woodbine Parish.

The committee have taken great care to establish the Guild on a sound and permanent basis. An interesting winter programme has been arranged. This includes a show of films connected with building, a talk on building in the U.S.A., a dance and a 'brains trust' to which the public will be admitted.

Membership is open to all over 17 years of age. The subscription is 7*s.* 6*d.* for all over 21, 5*s.* for those from 18 to 20, those aged 17 being admitted free.

Similar Guilds exist in Hull and Doncaster. The President and officers of the Hull Guild gave much valuable advice and information on the formation of the York Guild.

Ancient Monuments

On 27 September Sir Mortimer Wheeler opened an exhibition of photographs from THE TIMES illustrating the Ministry of Works' guardianship over the ancient monuments of England and Wales. The various kinds of ancient monuments with which the Ministry has to deal were exemplified by nearly 80 photographs, displayed in the Arts Council Gallery, St. James's Square, S.W.1. Colonel J. J. Astor, chairman and managing director of THE TIMES, introduced Sir Mortimer Wheeler, who spoke of the present-day threats to our heritage of monuments and buildings, a heritage in which the public were taking a growing interest. In his opinion the Ancient Monuments Act and its administration were the best in the world.

Sir David Eccles, Minister of Works, welcomed the exhibition as giving the public an opportunity to see something of the nation-wide work of preservation being done by the Ancient Monuments division of his Ministry. This year the Government were spending £600,000 on the preservation of historic monuments and buildings, which was twice as much as any previous Government had spent in a year. Forty excavations were being carried out in various parts of the country and were receiving a total ministerial grant of £20,000 a year.

Productivity in the Building Industry

The British Productivity Council have issued a booklet entitled *Getting Together*; it is a review of productivity in the building industry. The President has written of it, 'I should like to draw the attention of all people who are concerned with good and efficient building to the contents of this review as it is, in my opinion, of prime importance to everybody connected with the building industry to make it his business to know what is going on in the industry, and to help stimulate and use some of the ideas which are presented here.'

The review begins by stating that since the war building in the United Kingdom has been the subject of much criticism, some justified and some not, and that probably no other industry has been the subject of more searching inquiries into its procedures.

It discusses these criticisms in detail from the point of view of each constituent of the industry. With labour there continues to be bad continuity of employment in any particular area, though there has been a tendency for builders to retain labour and to form teams where possible. Nevertheless by 1953 output per employee was 10 per cent above that of 1948, half of this increase occurring in 1953 and most of it going into housebuilding.

Much of the sharp rise in building costs is due to factors beyond the industry's own control, such as the rise in wages and the increased cost of raw materials, both having risen about two-and-a-half times since 1939.

Despite the general acceptance of the principles of pre-planning there is reason to believe that the practice is not being sufficiently widely adopted, the onus for this lying largely on the shoulders of the building owner. But although not all architects are doing as much as they can in the matter of pre-planning it is unfair to lay all the blame for delays on them. Too many contractors tend to dismiss their particular difficulties lightly. It is equally true that some architects lay much of the blame for delays on the contractor without fully appreciating *his* difficulties, especially as regards labour and getting supplies. During the training of architects more attention should be given to the business side and particularly the costs aspects of building.

Tendering procedure and forms of contract are discussed, the reports of the Joint Committee on Tendering Procedure and the Working Party being analysed. Modular co-ordination, its advantages and drawbacks, the use of standard and prefabricated components and its effect on output, types of incentive and their effectiveness are among several subjects discussed in detail.

The booklet is obtainable from The British Productivity Council, 21 Tothill Street, London, S.W.1, price 2*s.* 3*d.*

The London Builders' Conference

The report of the Monopolies and Restrictive Practices Commission on the 'Supply of Buildings in the Greater London Area' has been published. It is obtainable from H.M. Stationery Office, price 3*s.* 6*d.* A summary of the report is published on pages 503-4 of this JOURNAL.

The Royal Institute submitted both written and oral evidence to the Commission, whose findings confirm the views expressed by the Royal Institute and by the Royal Institution of Chartered Surveyors.

R.I.B.A. Visitors and Travel in 1954

The R.I.B.A. continues to entertain a large number of visitors from abroad. Some arrive after lengthy correspondence in large well-conducted groups, equipped with guides and interpreters; others in unheralded ones and twos, sometimes speaking little or no English, always intensely curious about Britain and her architecture. All are welcomed but especially those who offer a favourable opportunity for the exchange (even by gesture) of information and opinions.

Australians and Americans still preponderate but this year South Africa, India, Israel, Portugal, Canada, the Philippines, the West Indies, Sweden, Belgium and Japan have all been represented. All are enthusiastic about the Institute building and often produce or compile notes, plans and diagrams. Visitors from Japan especially have a great appetite for precise information.

It is gratifying to record that an increasing number of visitors now penetrate beyond London and its ring of New Towns, and while most visitors remain in the south some have travelled as far as Scotland and North Wales. The tendency to visit Oxford rather than Cambridge is to be ascribed presumably to the superior train service enjoyed by the former city.

It has been a good year for travel abroad; the Institute has issued over 180 R.I.B.A. Travel Cards so far and (on behalf of the British Council) 30 Council of Europe Cultural Identity Cards. These latter are in great demand since they now carry considerable privileges including, in some countries, reduced travel rates and cheaper theatre tickets, but their issue is rather strictly regulated and the Royal Institute is reluctantly obliged to refuse a certain number of applications.

The Royal Institute continues to receive many requests for letters of introduction to architectural societies and Honorary Corresponding Members. While the majority of these are for Western Europe, it would appear that architects and students are beginning to make sorties through the Iron Curtain in the course of their architectural researches.

The Royal Institute is most grateful to those of its members who have assisted with information and advice in its efforts to help visitors to Britain and travellers overseas and to those who have spared the time to attend at Portland Place to receive parties or individuals.

Coal Utilisation Council's Display at the Building Centre

The Coal Utilisation Council have now opened a new display and information bureau at the Building Centre, Store Street, where the latest types of improved fires, cookers and other domestic solid fuel burning appliances can be seen and expert advice on their selection and use obtained.

The new display was opened on 30 September by Mr. Harold Macmillan, Minister of Housing and Local Government.

R.I.B.A. Diary

THURSDAY 21 OCTOBER–SATURDAY 30 OCTOBER. Exhibition, 'Building in Concrete'. Mon.–Fri. 10 a.m. to 7 p.m., Sat. 10 a.m. to 5 p.m.

TUESDAY 2 NOVEMBER. 6 P.M. Inaugural General Meeting. President's Inaugural Address. Unveiling of the portrait of Sir Howard Robertson, M.C., A.R.A., S.A.D.G., Past President. Presentation of London Architecture Bronze Medal.

The Thomas Linacre School, Wigan

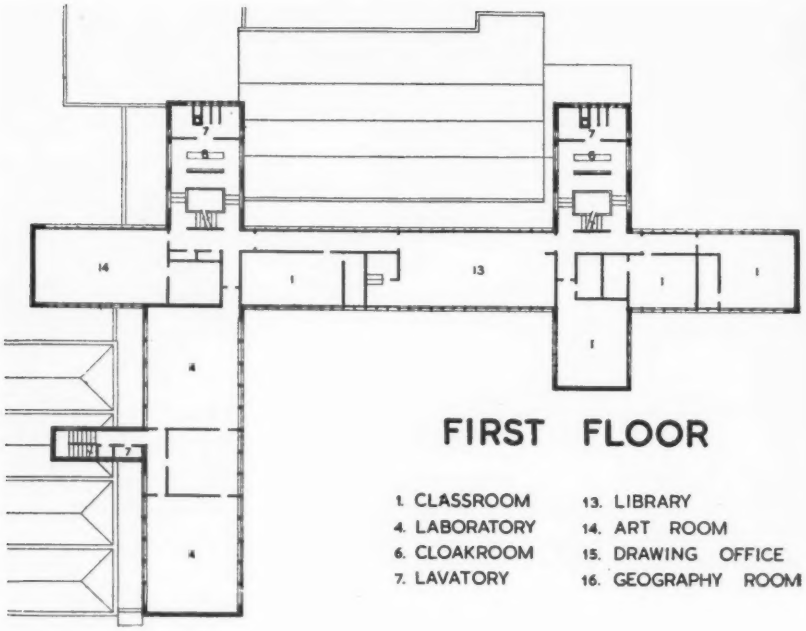
Associate Architects: Howard V. Lobb, C.B.E. [*F*], and G. Grenfell Baines and Hargreaves [*AA*]

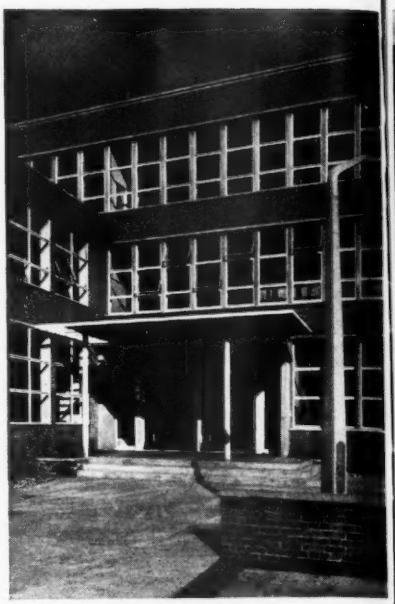
THIS TECHNICAL SCHOOL for 570 boys is part of an educational centre which has been planned on the Rectory Glebe in the centre of Wigan. There is an existing grammar school adjacent to the site and the first portion of a college of further education, designed by the architects and complementary to the Thomas Linacre School, was opened by the Queen on 21 October.

On the same site a youth employment bureau is to be provided and the old rectory building is being used to house the education offices. The new school is named after Thomas Linacre, a Fellow of All Souls College, Oxford, first President of the Royal College of Physicians and Rector of Wigan from 1520 to his death in 1524.

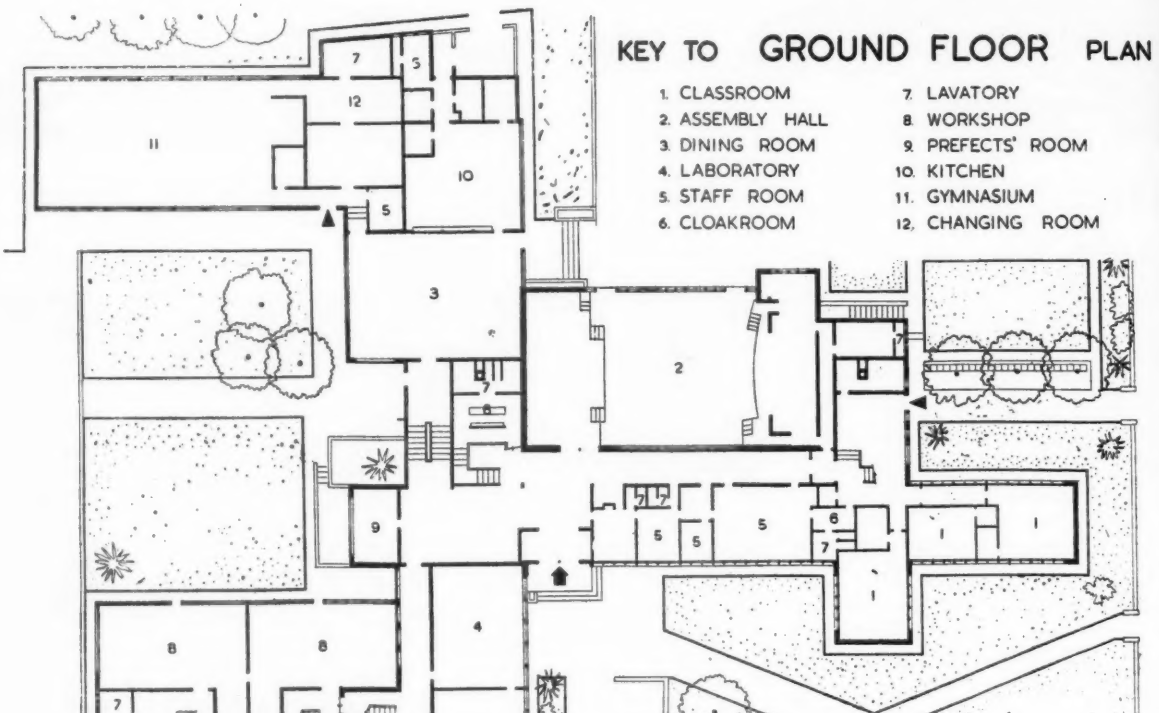
The building consists of three storeys of classrooms, arranged in a clover leaf plan of three classrooms accessible from each of the staircases; a similar arrangement has been adopted with the two-storey wing of laboratories. This has resulted in great economy of circulation space. In one single-storey wing is the gymnasium with changing rooms, linked to the main

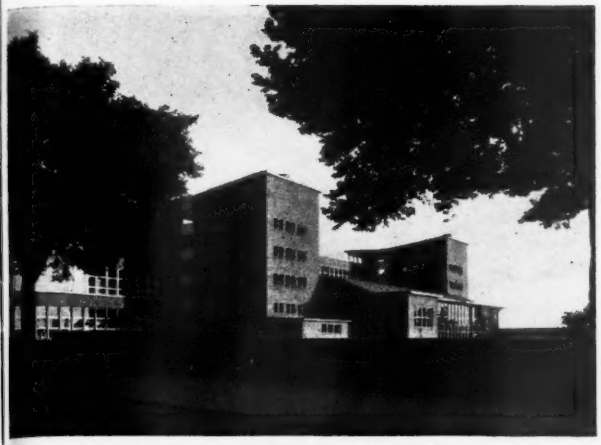
The main entrance and laboratory wing at night





Details of the main entrance. The mullions are concrete and the bricks dark red Ravenhead rustics of controlled selection





The two staircase and lavatory blocks with the hall between

The south-western courtyard with gymnasium on the left and workshops on the right

building by the kitchen and dining-hall. Another single-storey wing houses the workshops at a lower level; this wing has a novel section, the stores being located in the centre of the plan and having a mezzanine floor over at ground floor level for exhibitions and demonstrations. There are sloping inspection windows overlooking the taller workshops.

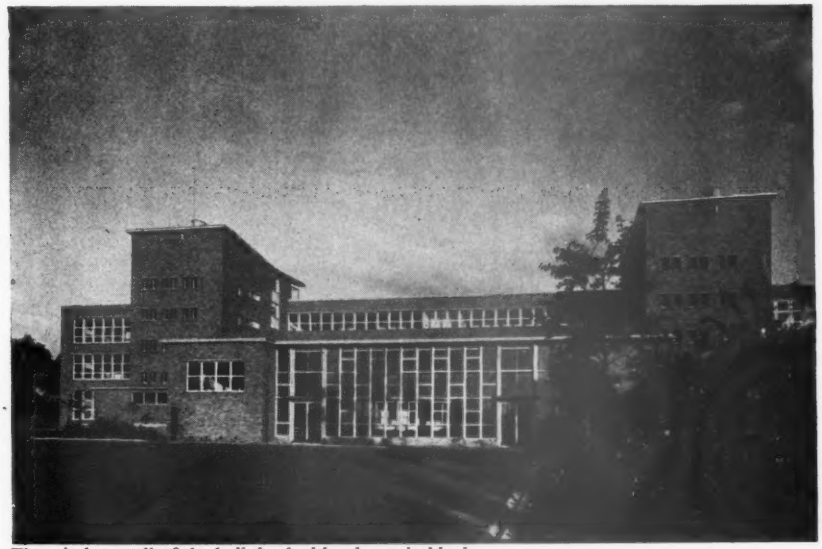
The hall, which is approached directly from the main entrance, has a raised portion at the end opposite the stage, from which one descends to the hall floor; on the raised portion there are two rows of seats at the front for distinguished visitors. This arrangement of floor levels gives an amphitheatre effect; the three rear rows are stepped. This arrangement is shown in the cover picture. Sliding glass panels and curtains along the adjoining corridor allow overflow audiences to be accommodated in what is in effect a side balcony. The stage is fully equipped for amateur performances and is much used for this purpose.

The two main staircases have lavatories and cloakrooms at half-landing level. They ascend to the flat roof and terminate in glazed lobbies for geographical work and observations. The roof is open to the boys and gives good views of the surroundings. At the head of each stair is a mural. One illustrates the characteristic industries of Wigan and its neighbourhood and the town's other schools, both old and new. They have been painted by Mr. Colin C. Giffard [*A*].

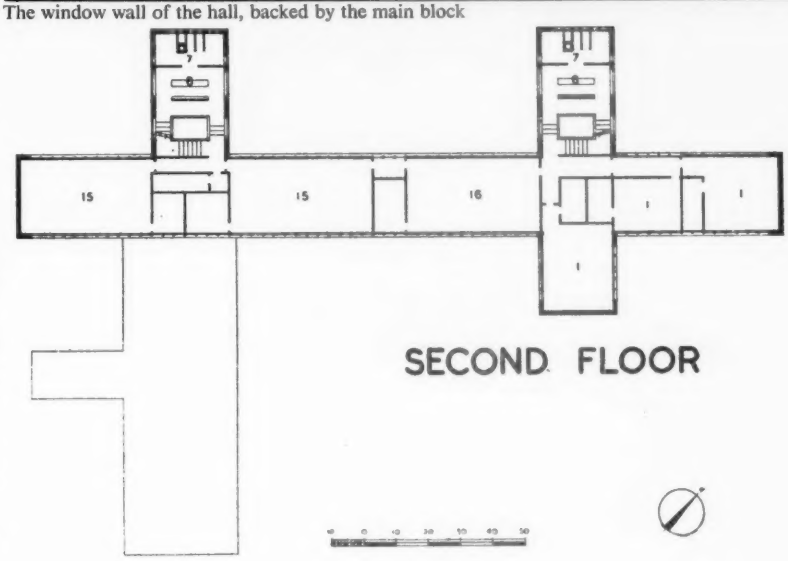
The main structure consists of a series of twin precast reinforced concrete frame units. Each unit consists of two columns joined by head and sill beams; these beams extend as half-span cantilevers and are joined with the cantilevers of the next frame unit by bolting. Each unit extends storey height and is bolted to the units above or below. Each unit covers two bays of a 40½ in. structural grid.

In each column a duct, 3 in. by 3 in. in cross-section, is formed up the inside face; this gives a series of vertical ducts throughout the building and to full height.

Prestressed floor beams of inverted tee section are bolted to the head beams of the



The window wall of the hall, backed by the main block



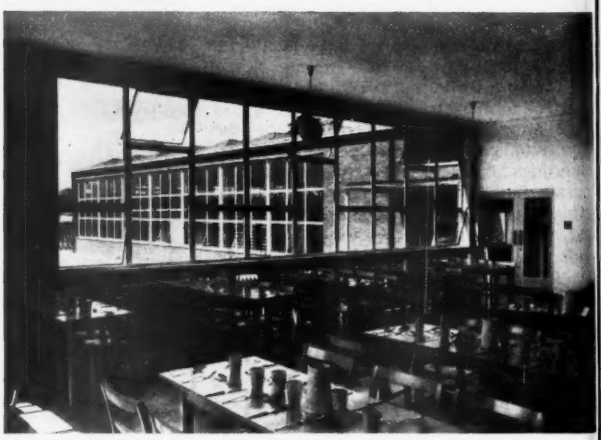
The library

The geography room

The drawing office

The chemistry laboratory

The headmaster's room



The dining room

frames between the columns. The space between these beams is infilled with precast concrete recessed slabs which, placed alternately upwards and downwards, form coffered ceilings; they bear on the flanges of the inverted tee beams. Spanning across the top of the beams is corrugated-iron permanent shuttering carrying the structural floor screeds. The space thus formed is used for horizontal service runs and, because the ends of the prestressed beams are fixed *between* the columns, the vertical and horizontal ducts are linked without obstruction. As a result, exposed pipework and electrical conduit, always a problem attendant on using exposed precast concrete, is kept to a minimum.

The beams spanning the laboratories have exposed steel tension members and support precast trough units.

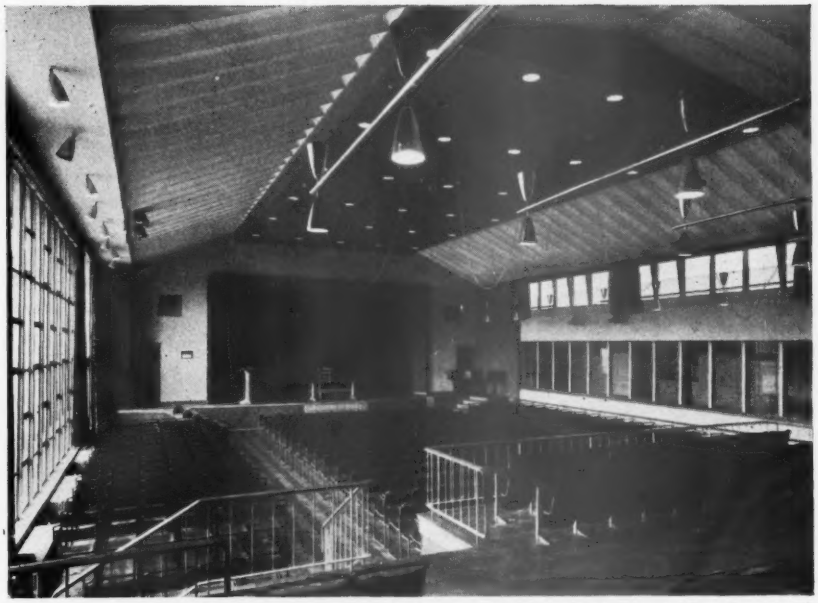
The roof of the hall is a novel form of

shell. This was described and illustrated by Mr. F. J. Samuely, who designed it, in his paper *Space Frames and Stressed Skin Construction* given at the R.I.B.A. in March 1952. It consists of four planes of precast trough units which were temporarily supported on scaffolding and covered with in situ concrete. It spans the long way of the hall, 75 ft., is carried on two beams, one in the proscenium wall and one in the end wall, and cantilevers 25 ft. beyond.

The roofs of the workshop block and gymnasium are space frames, the form of which can be seen in the photographs. They are of small sectioned steel angles, tubes and rods and span 91 ft. by 82 ft. and 82 ft. by 39 ft. respectively. After full loading, the panels of the workshop roof were post-stressed by cables spanning between apexes, hips and eaves. The structural design was much influenced by steel rationing at the time the school was started; the weight of steel of the workshop roof is only 4½ lb. per sq. ft.

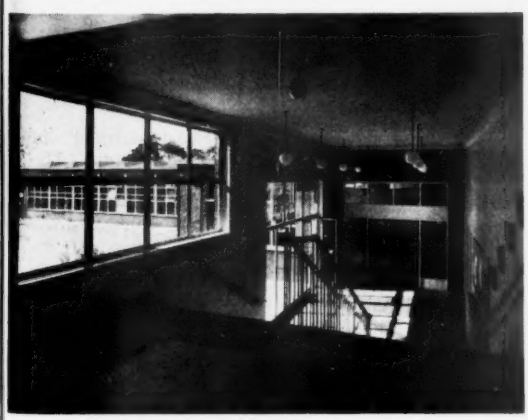
Rustic facing brick is used for the exterior, the concrete columns which form mullions being left exposed. The windows are steel. The flat roofs are bituminous ply.

Piling for the foundation started in March 1951 and construction in February



The hall. The stage and raised portion at the back are at the ground floor level. The glass panels along the corridor can be telescoped to permit extra seating.

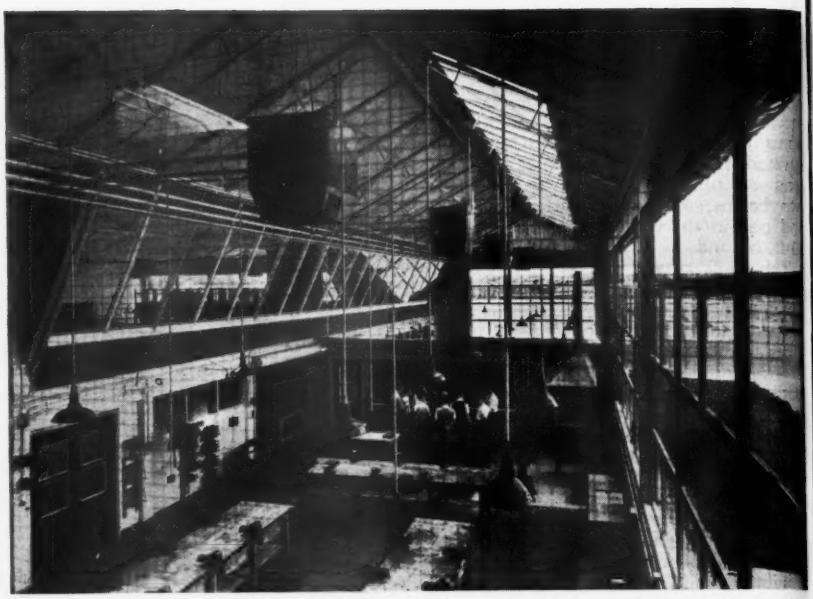
The entrance hall looking towards the front door. The illuminated glass case for school trophies is glazed on opposite sides. The floor is a chequerboard pattern of thermoplastic tiles.



The stairs leading to the dining room

The hall, the roof of which is a space frame in precast and in-situ concrete

The carpentry workshop. The workshops are heated by suspended unit heaters.



The metal workshop showing the observation windows from the demonstration space over the materials stores. The photograph is taken through a borrowed light of Georgian wired glass

Part of the demonstration area over the workshop stores

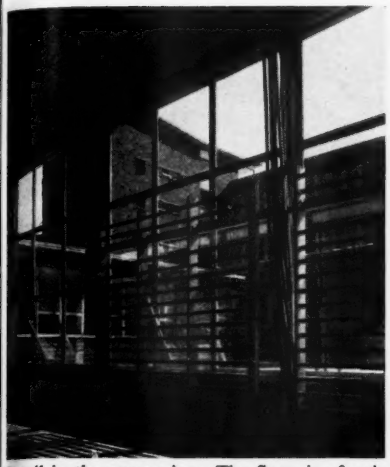
An observation window. The roof is a space frame spanning 91 ft. by 82 ft.

1952. The building was finished in September 1953. The cost was £232,275.

Although the photographs reproduce the shapes and tone values of the interiors, they cannot convey the colour schemes which are such a notable feature of this school. The hall in particular has richness as well as dignity. Everywhere the colours enhance and blend with woodwork and metalwork to make a succession of stimulating and interesting interiors. There is an absence of that sameness which is so often found in school buildings, so that one walks round it continuously finding new things to look at, enhanced with pleasing effects of colour.

A school has been created. By this is meant not merely that an interesting building has been finished, but that the headmaster, staff and boys have blended with the building into an organic whole which has unity already and the beginnings of a tradition. In this, no small credit goes to the headmaster, Mr. W. S. Brace, who was quick to realise the possible effect of so bright and clean a building on morale. He writes that, although the boys 'have not turned into angels' within a very short time, 'a standard and pattern of behaviour has developed in the school which has delighted us.' He goes on 'Almost without exception, the boys feel forced to maintain high standards—the building, through its lightness, brightness and cleanness, encourages self-discipline. This effect was quite rapid; it was clearly marked within two months of the school's opening.' This is an authoritative testimonial to the quality of the architecture, and to its beneficial effect on those who use the building.

The consulting engineer was Mr. F. J. Samuely, B.Sc.(Eng.), A.M.I.C.E., M.I. Struct.E. The chief assistant was Mr. John Wilkinson [*A*]. Mr. W. A. Allen [*A*] and Mr. J. B. Bickerdike [*A*], officers of the Building Research Station, collaborated in the design of the lighting schemes for the hall and classrooms. Mr. Hope Bagenal [*F*] advised on acoustics. The contractors were Leonard Fairclough Ltd.



Detail in the gymnasium. The floor is of strip hardwood

The gymnasium has a small gallery for spectators above the equipment storage. The roof is a space frame in steel angles, tubes and rods, spanning 82 ft. by 39 ft., and is painted a neutral colour to form a background in ball games

Mural depicting the schools of Wigan. Both murals face large glass areas

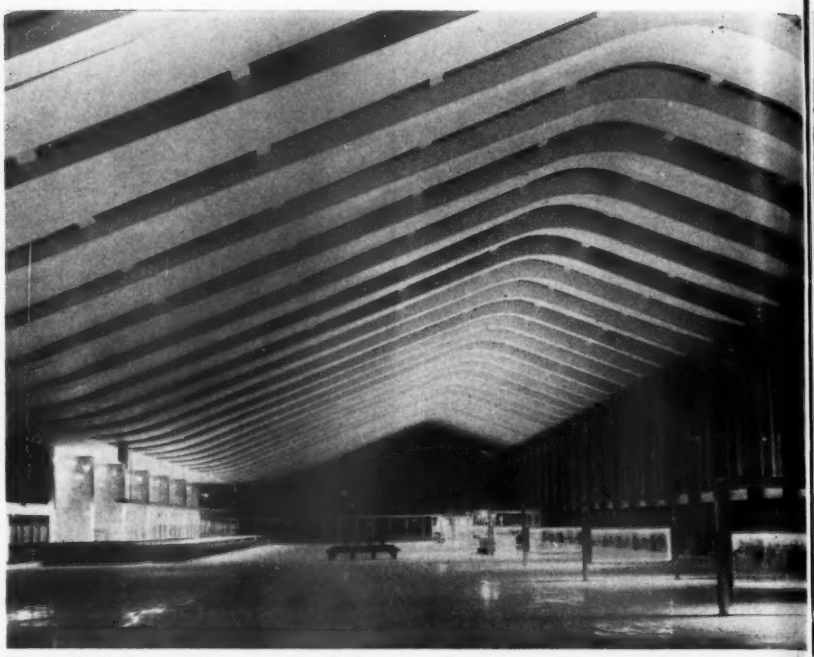
The two murals at the heads of the staircases are by Mr. Colin C. Giffard [*A*]. This one depicts the industries of Wigan

The staircases give access to the lavatories at half-landing level. The balustrades are alternate round and square wrought iron rods

View at night of the window wall of the hall, flanked by the stair and lavatory towers

The Building in Concrete Exhibition

At the R.I.B.A. 21 to 30 October

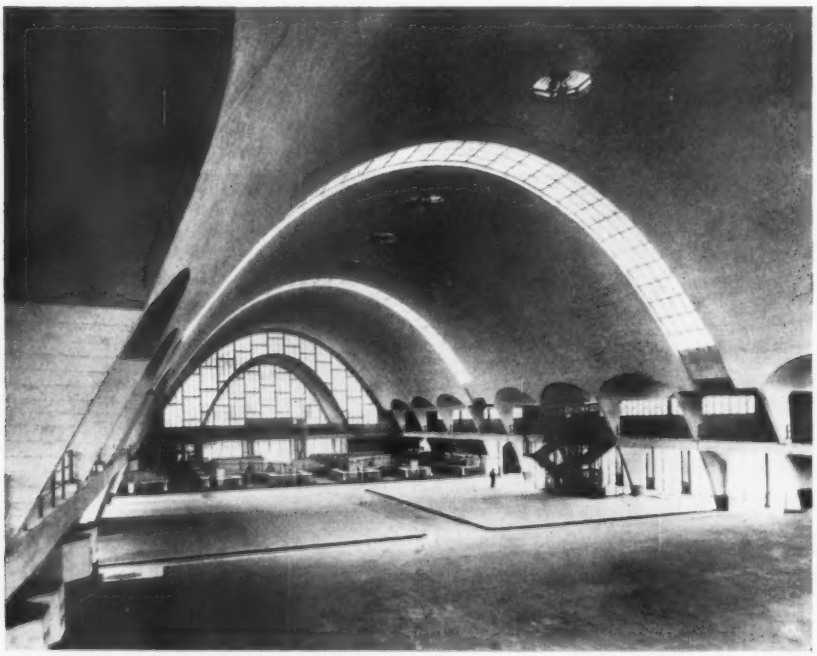


The hall of Rome railway station. Architects and engineers: Montuori, Castellazzi, Calini, Fatigati and Pintonello

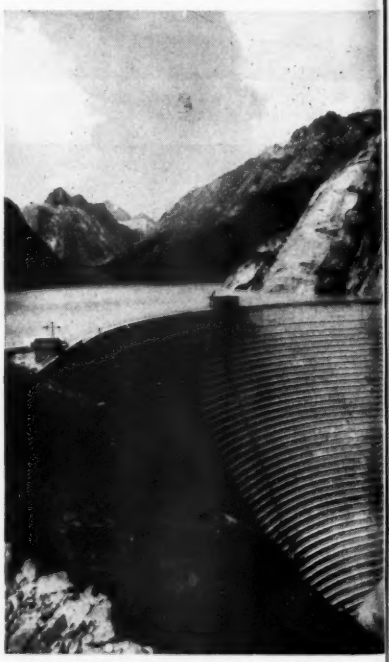
THE EXHIBITION is a display of excellent photographs illustrating the architectural use of reinforced concrete. Although this material is a hundred years old, its use in architecture has extended over little more than the last fifty. Hennebique's office building (1900) in the Rue Danton in Paris is the first picture in the historical section of the exhibition; the second is a factory built in Hull by Mouchel, also in 1900. But it was not until Perret built his Rue Franklin flats in Paris in 1904 that true reinforced concrete framed structure was born. In 1906 Frank Lloyd Wright built what he described as 'the first concrete monolith in the world' at Oak Park. Thereafter in the hands of Le Corbusier, Robert Maillart, Eugene Freyssinet (the aircraft hangars at Orly in 1927), Gropius and other architects and engineers, reinforced concrete became established as a primary structural material.

The greater part of the exhibition consists of a selection of recent outstanding examples grouped according to building use. The sections are: schools, churches, industry and power, transport, recreation, hotels, shops and offices, public buildings, hospitals, flats, houses and bridges. They reveal the astonishing versatility of the material and the progress made by architects all over the world in its architectural expression.

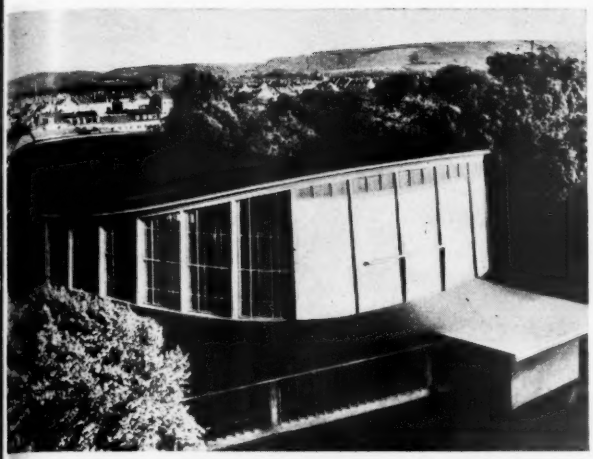
Unfortunately the exhibition is open for little more than a week, owing to other demands on the use of the Henry Florence Hall. Members should therefore not delay if they wish to see it. The opening hours are 10 a.m. to 7 p.m. (Saturdays 10 a.m. to 5 p.m.).



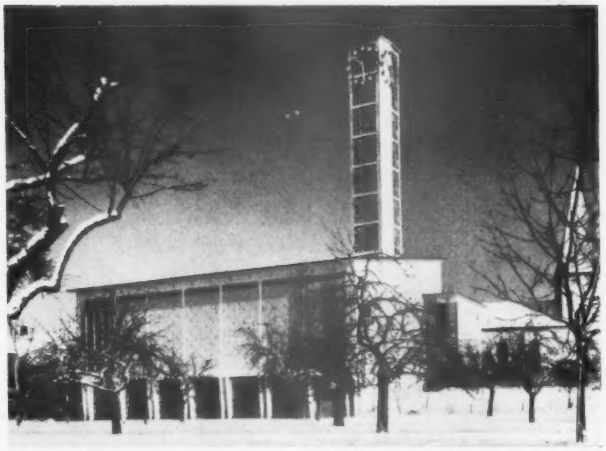
Market Hall, Rheims. Architect: E. Maigrot [*Photo: Chevojon*



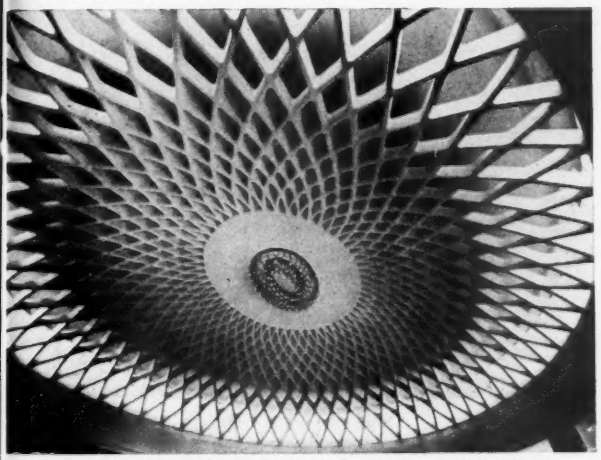
Spitallam Dam, Grimsel Lake, Switzerland



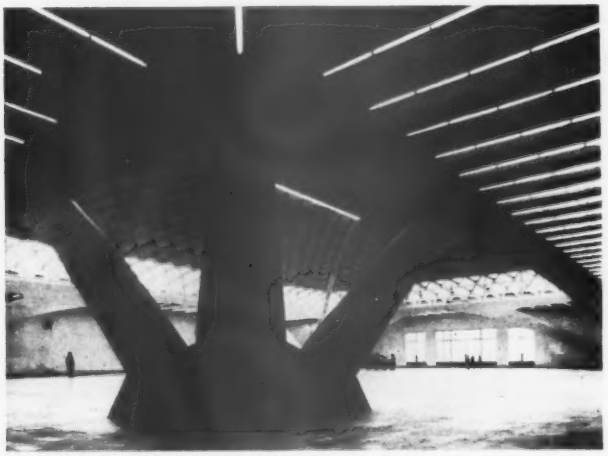
The Schwarzwaldhalle, Karlsruhe, Germany. Architect: Professor E. Schelling. *[Photo: Schlesiger, Karlsruhe*



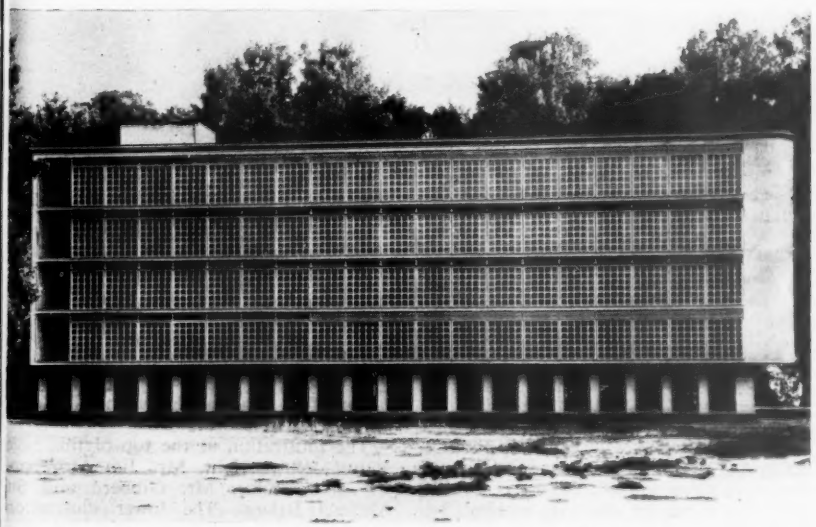
Reformed Church at Alstetten, Switzerland. Architect: W. Moser *[Photo: M. Walgensinger*



Roof in the Chianciano Health Baths, Italy. Engineer: P. L. Nervi



The exhibition hall, Turin. Engineer: P. L. Nervi



The Central Library at Lugano, Switzerland. Architects: Carlo and Rino Tami *[Photo: V. Vicari, Lugano*

Burgerspital (hospital), Basle. Architects: E. and P. Vischer and H. Baur

'Out of the Clouds'

HOW can an architect walk about the interior of his building before it is built? Here is Mr. Frederick Gibberd, C.B.E. [*F*], standing in the concourse of London Airport for which he is the architect, but the building will not be finished until next year.

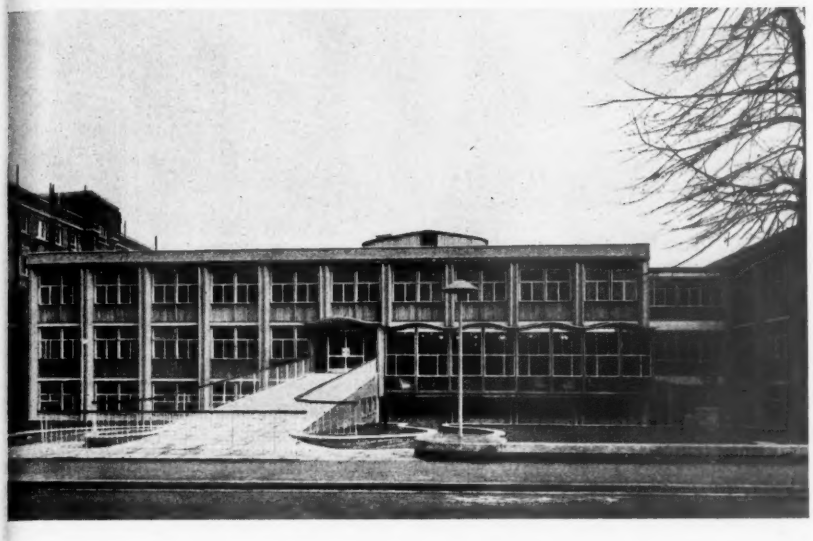
The answer lies in the dream world of the film. Ealing Studios are making a film with the title *Out of the Clouds*—'a tender love story played against the busy background of London Airport as it will be when it becomes the largest air terminus in the world'; and the producer, Sir Michael Balcon, has had a nearly full-size set made of the two-storeyed interior of the main concourse as it will appear when it is opened next year.

The set was constructed from Mr. Gibberd's detail drawings for the real building. It must have been an interesting and useful experience for him to see it. Perspective drawings may deceive by skilful draughtsmanship and models fail to convey scale and size, but a full-size preconstruction is more or less exact in its resemblance to the future reality. One can walk about it, study it from all angles and experience the feeling of being within an interior; this last sensation is one for which the architect has to rely solely on his powers of visualisation. Unfortunately the making of a full-sized model is an undertaking which few clients would care to afford.

The illustration at the top of this page shows, left to right, Mr. Jim Morahan, the art director, Mr. Gibberd and Sir Michael Balcon. The lower illustration shows shooting in progress, with the other side of the concourse as background.

St. James' Hospital, Balham: Out-Patients' Department

Architects: Alan H. Devereux [*F*], and Elidir L. W. Davies [*F*]

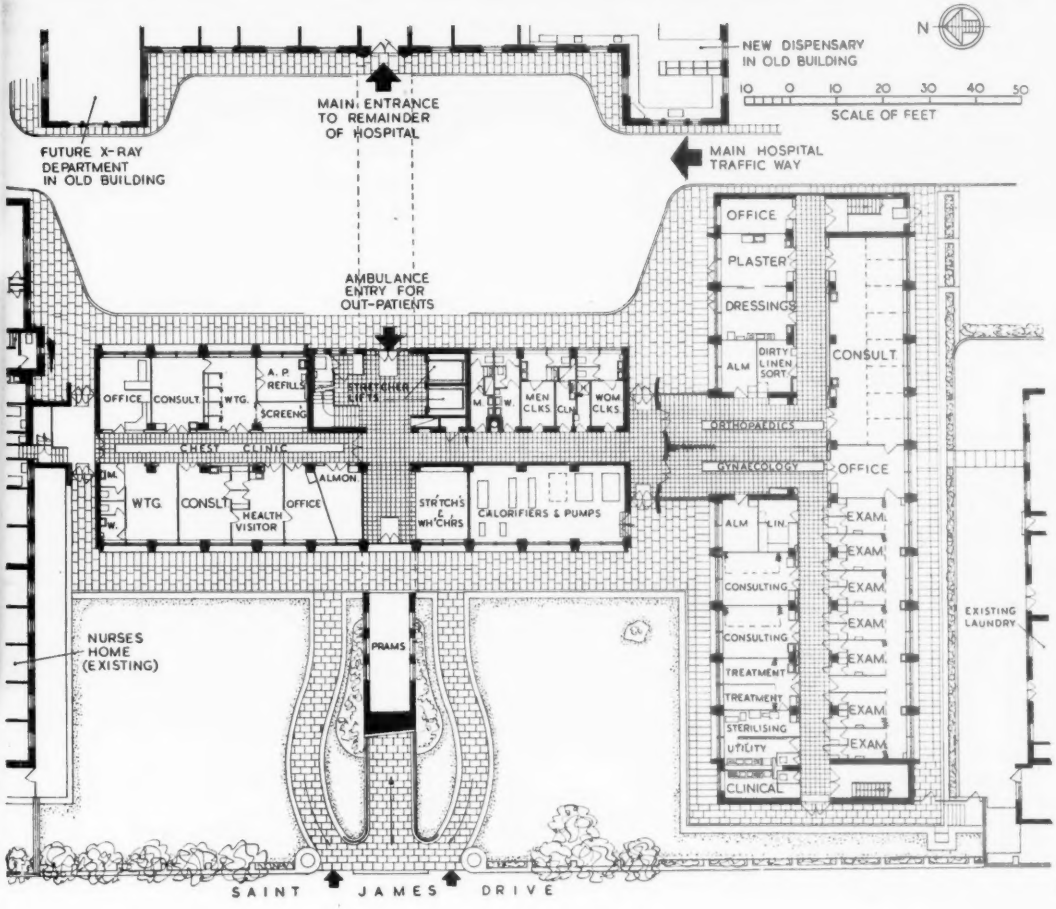


THE R.I.B.A: London Architecture Bronze Medal for 1953 has been awarded to the architects in respect of this building.

St. James' Hospital, originally a Board of Guardians infirmary, has grown into a very important general hospital. It possesses a fairly modern central block, but otherwise much of the building has become obsolescent under the many changes in medical and surgical practice which have taken place since it was built. The architects have prepared a master plan for complete modernisation of the hospital and this out-patients' department is the first new building in it.

The department is placed across what was once the main entrance of the hospital. This discharged into a traffic-laden main road. A new entrance for ambulances into a side street has now been made, access from the main road being for pedestrians only.

The restricted site largely determined the T-shaped plan of the department; this plan allowed the formation of a courtyard for



Ground floor plan

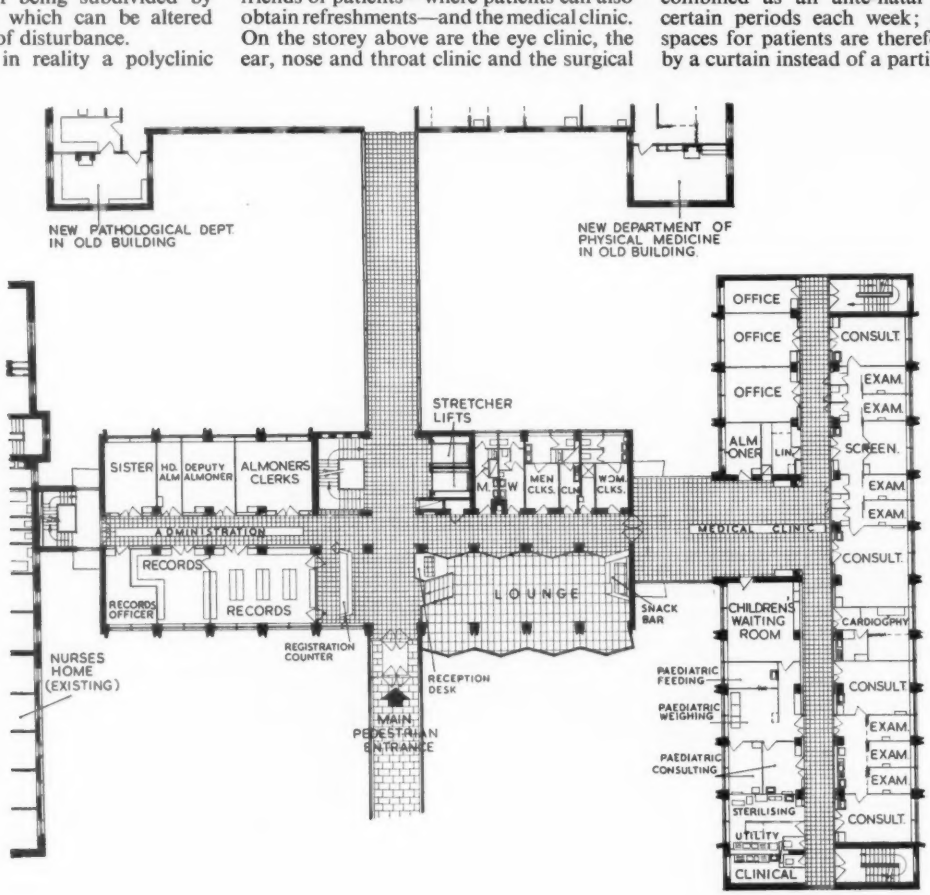
ambulances. The entrance floor of the department has been placed at a level corresponding with that of the first floor of the central block to permit the two buildings to be connected by a bridge high enough for ambulances to pass beneath. The existing central block, which has been largely converted, now houses the X-ray, pathology, pharmacy, dispensary and physiotherapy departments, all of which have to be readily accessible to the out-patients' department. This arrangement of levels necessitated approach to the main entrance of the out-patients' department by means of a ramp. The ground floor is elevated enough to get abundant daylight to the interiors of rooms.

Bearing in mind the changes which have taken place and those which are likely to take place in the departments of a hospital, the architects decided to aim at the highest possible degree of flexibility in the planning and construction of the new building.

Apart from these changes, the clinics of an out-patients' department expand or diminish according to demand, so that minor adjustments of accommodation as well as major ones should be catered for. Therefore only the frame, floors, staircases and lavatories are permanent, the rest of the accommodation being subdivided by movable partitions which can be altered with the minimum of disturbance.

The building is in reality a polyclinic because it houses a number of separate clinics. On the entrance storey are the administration and waiting lounge for friends of patients—where patients can also obtain refreshments—and the medical clinic. On the storey above are the eye clinic, the ear, nose and throat clinic and the surgical clinic. The ground floor houses the chest clinic and the orthopaedic and gynaecology clinics. The two last are planned to be combined as an ante-natal clinic during certain periods each week; their waiting spaces for patients are therefore separated by a curtain instead of a partition.

Back elevation and bridge over the ambulance yard



First floor plan

One of the waiting rooms adjoining a clinic

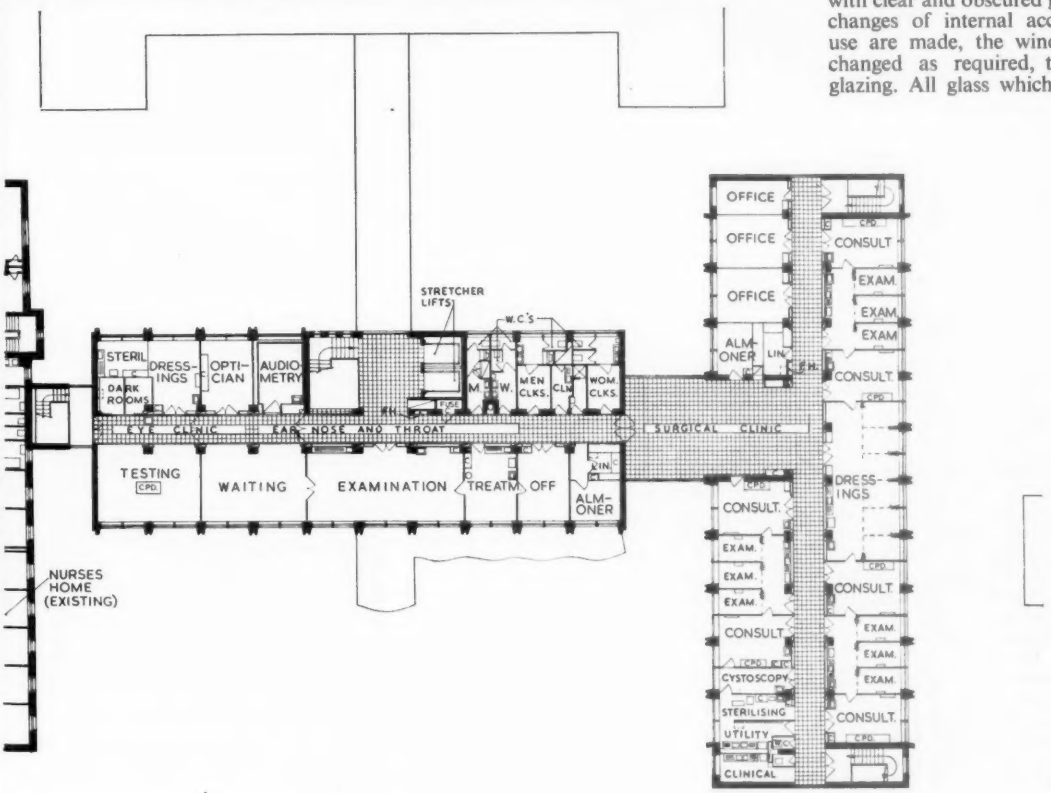
The whole building is planned at 11 ft. 6 in. centres, this being a useful width for a consulting room while the half dimension, 5 ft. 9 in., suits an examination cubicle. Room depths are standardised at 16 ft. which gives good penetration of daylight. The corridor width is 6 ft.

The structure consists of reinforced brick piers in Quetta bond, carrying prestressed floors spanning the 16 ft. across to the double row of internal columns; the corridors are spanned in ordinary reinforced concrete. Originally the structure was designed with an r.c. frame, but a steel shortage supervened and, to prevent the work being held up, the reinforced brick pier construction was substituted, thereby saving 125 tons of steel. The end walls are of solid brickwork. There are beams longitudinally between the internal piers only, but these are masked by a lowered ceiling in the corridor which houses the ventilation ducting. This ceiling is of perforated acoustic board which, with a cork-slab floor, helps to reduce corridor noise. The partition units are of laminated plastic sheet with extruded aluminium joints. They are fixed by a system of expanding jacks. The corridor partitions are double.

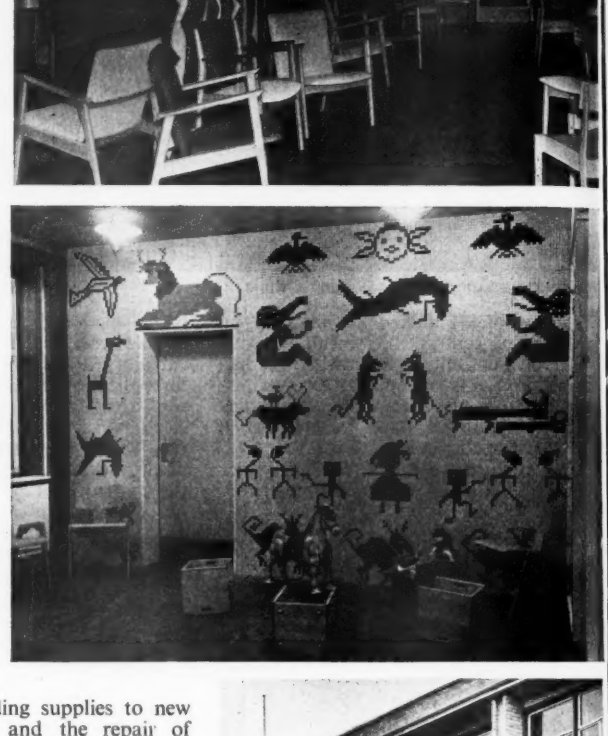
On the corridor side of every internal pier there is a vertical duct enclosed in plastic sheeting. These ducts contain steam, condense, hot and cold water supplies and wastes permitting washbasins or sterilising equipment to be quickly supplied to any half bay. The ducts descend to a crawlway beneath the ground floor in which are the horizontal runs of all the services. Ventilation can also be supplied to every half bay from the ducts in the corridor double ceilings. There is a similar system for the electrical services but located on the exterior piers, each of which has a composite unit fitting for power, light, telephone and telecommunication.

The principal means of heating is by flat panel radiators; these have hinged metal shelves to prevent dust discoloration of walls. The visitors' lounge and waiting spaces are warmed by coils embedded in the floor. Heat is supplied through calorifiers from the hospital's central plant.

The windows are standardised in two types of identical dimensions but glazed with clear and obscured glass so that, when changes of internal accommodation and use are made, the windows can also be changed as required, thus avoiding re-glazing. All glass which reaches down to



Second floor plan



Above: the visitors' lounge. Top right: twin waiting rooms between two clinics, separated by a curtain. Right: mosaic in children's room by Vera Davies

the floor is armourplate. Venetian blinds and blackout blinds have been provided where required.

Lever door handles, designed by the architects, have been provided at all doors in clinic rooms. The lever is long and tilted slightly upwards so that sliding the elbow along it operates the latch. This has been much appreciated by the staff who often have to carry trays and other objects requiring both hands. Dirty linen and dressings shutes have been installed at convenient points and a hopper type opening in the wall discharges used plaster casts to bins outside the building.

In their general approach to the design, the architects have had specially in mind three features which they think have been somewhat neglected in hospital buildings in the past. The first, ease of adaptation to new purposes, has been discussed above.

The second aim has been to reduce maintenance to a minimum. In the first place, painted surfaces have been reduced to about one-sixth of what is normal in a building of this size. But dislocation of a building's use inflates maintenance costs. The co-ordination of the services and their accessibility means that both minor alterations, such as providing supplies to new pieces of apparatus and the repair of services, can be done with little disturbance to rooms.

The third aim has been to make the building friendly and non-institutional. To avoid this, the building has been made human in scale, bright clear colours have been used, timber has been employed decoratively both inside and outside in exceptional amounts, textiles are gay and cheerful. The visitors' lounge is more friendly and welcoming than many a hotel lounge. A bright and cheerful mosaic decorates the children's waiting room of the paediatric portion of the medical clinic. Furniture, such as the consultant's desks, tables, couches and cupboards, has been designed specially. Light fittings have been chosen for their decorative qualities as much as for their efficiency. Each of the clinics is identified by a predominant colour, mostly in pastel shades, relieved by the predominant use of pure white.

Chief Architectural Assistant, Mr. L. E. Martin [*A*]. Structural Engineers, Clarke, Nicholls and Marcel. Mechanical Engineer, Mr. H. A. Sandford. Quantity Surveyor, Mr. J. K. Carless. Contractors, Marshall Andrew & Co. Ltd. Clerk of Works, Mr. F. Duckett.

Bronze figure by Douglas Wain-Hobson

The General Design Problems of the Hospital

By R. Llewelyn Davies, B.A. (Cantab.) [*A*], Director, Division for Architectural Studies, Nuffield Foundation

Read at the R.I.B.A. Hospitals Conference, 21 October 1954. Mr. J. H. Forshaw, C.B., M.C., M.T.P.I. [*F*] in the Chair

Introduction. This paper deals with some of the problems of hospital design in the light of research carried out by the Investigation into the Functions and Design of Hospitals and more recently by the Division for Architectural Studies of the Nuffield Foundation.

Before entering into a discussion of some of the problems connected with hospital design, it is worth looking briefly at the present role of architectural research, and its relation to practice.

As we see it, the object of research into hospital design, as into any architectural subject, is to provide the practising architect with the tools of design. Most emphatically the object is not to produce an ideal design, a type plan or a standard. Not only is every hospital a special problem requiring an individual solution, but also hospital design is constantly evolving, and must do so if it is to keep pace with medical and social changes.

Design is essentially a synthesis, taking into account the total situation, and many of the considerations which the designer must weigh are not susceptible to scientific study. On the other hand some are, and the object of research is to study these aspects and provide the designer with knowledge which can contribute to, although it should never control, his solution of any particular problem. The task of thinking out the needs in a particular case and finding the best architectural and organisational expression for them must remain with the hospital authorities and their architects. There is perhaps some analogy with medical research which does not attempt to standardise diagnosis or treatment, but provides the practising clinician with knowledge and methods which he can apply so far as appropriate in any particular case.

The Problem of Size: Planning to Meet Demand. One of the first problems which the hospital authority and the architect have to consider when faced with the design of a building, whether it be a complete hospital, an individual department or a ward block, is the problem of size. On what scale is accommodation required?

Hospitals exist to meet the demand for care arising from the population which they serve. Until comparatively recently the supply, in terms of hospital facilities, was usually well below the need. Any additional service provided through the building of new hospitals has always been rapidly absorbed by the community. But we can no longer afford to provide services without first trying to assess the true demand for them. We must see to it that the limited resources available for hospital construction are used in the best way—that is, to provide a balanced service.

The Investigation has undertaken a special study of the means whereby the demand for hospital care from a population can be measured. In the course of the study, a case-load survey covering the area of the Norfolk and Norwich group of hospitals, serving a population of approximately 500,000, was made. The results of this survey established what was the explicit demand during 1951 for in-patient beds in each specialty, for out-patient sessions in each specialty, and for the casualty service. They also show the load of work, arising from in-patients and out-patients in each specialty, put on the operating theatres and departments of radio-diagnosis and pathology.

A survey of this sort can give a picture of the demand for hospital care and can be used to guide a building programme, and it is suggested that any hospital authority faced with an important building programme could well make a survey of demand in its own area. This has in fact been done by the Hospital Board for the Eastern Region of Scotland, preparatory to drawing up the schedule of requirements for an important new hospital in Dundee. Thus a quantitative basis can be established for the design, and we need not 'continue to plan by guesswork, opinion and probability, an unhappy triumvirate, which makes the architect's work difficult and which may lead equally to over-building or to under-building the hospital'.[1]

If the annual in-patient demand in a particular specialty is on average n patients, then the *critical* number of beds—which must be slightly exceeded in practice—is

$$x = \frac{n \times L}{365 \times a}$$

where L is the average length of stay, and a is the occupancy rate achieved *when there is a waiting list*, i.e. rate due to administrative efficiency. For example, suppose $n = 400$, $L = 10$ and $a = 0{\cdot}8$, then

$$x = \frac{400 \times 10}{365 \times 0{\cdot}8} = 13{\cdot}7$$

In order to have a *finite* average waiting time the critical number must always be exceeded so as to allow for fluctuations in demand and length of stay. We should require about 15 beds in this case to attain reasonably good working conditions. The number needed in relation to waiting time and queue length has been studied by the Investigation. It should be noted that the determination of average length of stay and occupancy rates must be considered in relation to the particular specialty and local conditions. National averages are not satisfactory for this purpose. Similar considerations apply to out-patient departments.

The number of out-patient sessions to be provided for can be calculated from the weekly demand. This must be done for each specialty separately. If m is the average weekly demand for consultation then the *critical* number of sessions required will be

$$y = \frac{m \times t}{s}$$

where t = average consulting time in minutes, and s = the total length of each session in minutes. For example, suppose there is a demand for 120 attendances weekly in one specialty, the average consultation time is 5 minutes and the length of the session is 150 minutes, then $y = 4$ sessions per week. This is the critical supply, which must be somewhat exceeded in practice.

Seasonal fluctuations, as distinct from ordinary random fluctuations from day to day, have to be considered separately. With out-patient departments we may be able to analyse data quarter by quarter, say, and show how different provision is required

Average Times for Consultation and Examination in a Number of Clinics

Clinic	New Patients		Old Patients	
	Receiving Consultation	Average Time (to nearest minute)	Receiving Consultation	Average Time (to nearest minute)
General medical	20	19	55	11
Gastric	36	20	242	8
Diabetic	–*	–	87	6
Anaemia	23	17	67	9
Chest	19	15	64	10

* Only one new patient presented himself at this clinic.

according as the *average level of demand* is high or low.

Average consulting times for a number of specialties as observed by the Investigation are given in the table on page 485. These are average times observed in practice. These figures should not be used in the planning of a new hospital, without due consideration for local conditions and trends in medicine.

From the sessions per week the number of consulting suites can be calculated. For example, suppose provision is required for the following sessions:

Clinic	No. of Sessions per Week
1. General medicine	14
2. General surgery	17
3. Gynaecology	8
4. Dermatology	4
5. Psychiatry	8

Supposing that each consultant in general surgery, general medicine, and dermatology required the use of two rooms, the gynaecologist the use of four rooms and the psychiatrist one, then we have:

General Medicine General Surgery Dermatology	35 sessions per week requiring 2 rooms
Gynaecology	8 sessions per week requiring 4 rooms
Psychiatry	8 sessions per week requiring 1 room

Thus a four-room general purpose suite would be required as follows:

General Medicine General Surgery Dermatology	17½ sessions
Gynaecology	8 sessions
Psychiatry	2 sessions
	27½, say 28, sessions per week.

Three four-room suites would therefore be needed, providing an available weekly total of 33 sessions. A complete four-room suite would be unused for 5 sessions per week. This extra accommodation would probably be needed in order to allow for flexibility in the clinic programme. These calculations are based on the idea, supported by some of the Investigators' studies, that a standard consulting suite can be used at different times by different specialties. If accommodation is reserved solely for the use of a particular specialty, many more rooms would be needed and much of the accommodation would be unused at any given time.

Thus it is possible to calculate the provision to be made in terms of beds and consulting suites to meet a given demand, or conversely to say what load of cases given accommodation can be expected to cope with.

The Investigation's case-load studies give some indication as to the load to be expected on the special departments; they show, for example, how many X-rays of different types were called for by the out-patient and in-patient services during the period under survey and give similar information with regard to pathology and operating theatres. As, however, no data is available on the time needed for taking X-rays, making pathological tests or carrying out operations, it is not possible to use figures for demand as a guide to provision. For example, although we may know the demand in terms of X-rays with some accuracy, we cannot, so far, translate it into the number of X-ray sets or X-ray rooms likely to be required. Subjective estimates of the scale of provision for these departments vary enormously and there is scope for useful research in this field.

The Functional Requirements and Design of some of the Individual Departments within the Hospital. Calculations on the lines I have been describing can thus determine the scale of provision for some, if not yet for all, of the principal departments of the hospital. No two hospitals will be found to have the same requirements. Generally a new hospital is designed to supplement existing services in the area rather than to provide a completely comprehensive unit. Again, the approach to design will turn on the site, which may be large and unobstructed or very restricted. Hence there are no general rules for hospital planning.

The research with which I have been associated has been concentrated on the functional requirements of certain departments, particularly the ward, the out-patient department and the operating theatre. I do not propose in this paper to discuss the detailed design of these departments, but instead to bring out some of the considerations affecting the overall planning of the hospital as a whole, which derive from our study of each department separately. The central problems, as we have seen them, are economy of building space and of building cost, planning for flexibility in use and anticipating and providing for expansion.

I. Wards and Ward Blocks. The grouping of wards into ward blocks is a perennial subject of debate. In the eighteenth century, when small rooms were the rule, wards were often grouped compactly in buildings two or three storeys high. The open, pavilion ward which was first introduced on the Continent during the first half of the nineteenth century and which was approved by Florence Nightingale lent itself specially to single-storey design. A long corridor forms the spine of this arrangement; the wards form spurs on one or both sides with the long axis at right-angles to that of the corridor. The space between the wards is commonly about 40 ft. in width. The "Nightingale" ward had windows on both sides and was generally sited with its axis running north and south. Single-storey wards arranged in this way, although each ward looks into its neighbour on either side, are usually well lit, and the sun for much of the day can shine over adjoining buildings and through the windows. This gives them a pleasant atmosphere and the enclosed gardens or courts can be very agreeable—as they are, for example, at the Kettering General Hospital.

The major objection to this layout is that for a hospital of any size it occupies a great deal of ground and results in considerable walking distances. Attempts have been made to reach a greater compactness while preserving the essentials of the layout. A unique and ingenious modification of the single-storey layout is to be seen at the Royal Victoria Hospital, Belfast, built in 1903. Fig. 1 shows the ward layout of this hospital. Here the wards are artificially ventilated. Thus they can be placed side by side without any intervening open spaces, giving a very compact arrangement. The disadvantage is that there is no view from the wards, which are lit by high level clerestory windows.

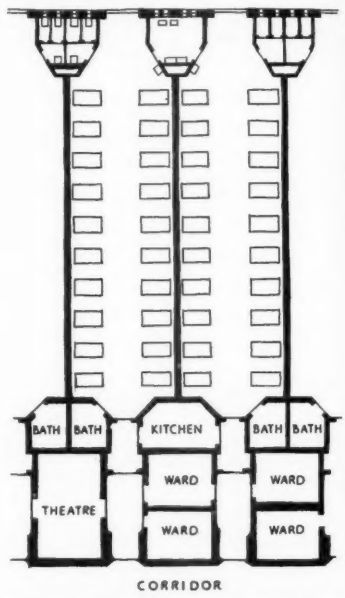


Fig. 1. Wards at the Royal Victoria Hospital, Belfast

Another modification seen in many hospitals built by the public assistance authorities around the turn of the century was the two-storey pavilion block. This arrangement halves the ground area required for a given number of beds but makes it necessary to provide lifts. The ground floor wards are disagreeably overlooked and overshadowed, and the courts or gardens between the blocks are apt to be dark and sunless. If the width between the blocks is enlarged to compensate for their increased height then the compactness which is the object of going to two storeys is immediately lost.

The arguments for stacking wards vertically, one above another, are quite strong. The majority of wards can be identical in plan and this lends itself to economical structural design, with bearing-walls or columns running unbroken through the height of the building. The same services, supplies and arrangements for disposal are required at the same point in each ward. Vertical plumbing stacks, pipe-runs and service lifts can therefore be planned to serve a large number of wards, placed one above another. Vertical planning can give good outlook, unobstructed sunlight and ventilation to all wards. Such considerations have led many architects, particularly on the Continent and in the United States, to design tall ward blocks, even on country sites where space is more or less unlimited. In this country, while high vertical blocks are used on restricted sites, there is a tendency to look for compromise solutions where more space is available.

In considering the different forms which a ward block may take, the position of the main vertical circulation, containing stairs and bedlifts, is critical. It is now a recognised principle that each ward should be a cul-de-sac and should not be used as a corridor for traffic to other wards or other parts of the hospital. Thus, each ward must have direct connection to the point of vertical circulation. Fig. 2 shows four arrangements to give one, two, three or four wards on each floor, served from one main staircase and lift-shaft. The more wards per floor, the lower will be the overall height of the ward block for a given total number of beds and the greater will be the use made of the lifts and stairs. Broadly speaking, the more beds per floor the more economical will be the building, both in first cost and in maintenance. The arrangement at A, Fig. 2, has only one ward per floor, and has been used in several new hospitals in Scandinavia. Arrangement B, Fig. 2, is often used for hospitals of medium size, recent examples being at St. Lô in Normandy and the new hospital for Swindon, Wiltshire. It gives more beds per floor than arrangement A, while maintaining the great advantage that the views from all wards are unobstructed and all have equally good sunlight.

Arrangement C, with three wards per floor, has been proposed for larger schemes, such as the very large new hospital at Helsinki, Finland. It provides more beds per floor than type B but is less satisfactory from the point of view of outlook and orientation. The cruciform block, type D, is advocated and used by the French architect, Jean Walter.[2] While it provides for the maximum number of beds to be served from one circulation point on each floor, view and sunlight are much obstructed, the outlook from windows near the centre of the block is very forbidding, and a disagreeable character is created in the rooms.

In this country, where there is some sentiment against tall buildings, arrangements such as that shown in Fig. 3 are sometimes adopted, in which a number of blocks three or four storeys in height are strung together. If the cul-de-sac principle is maintained this results in several points of vertical circulation, each of which has to have stairs and bedlifts. Circulation at ground level is complex, as access to the foot of each staircase has to be provided not only for people but for a considerable variety of supplies coming from different points.

The total number of beds required in the hospital and the limits set to the height of the building are generally the crucial factors in determining which solution is adopted. The limits to be set for height are difficult to fix and technical considerations in themselves do not provide any clear answer. At one time, fire risk was thought of as setting a height limit but this is no longer so today. It is now felt that the essence of fire protection is the provision of separate compartments on each floor so that evacuation can be made horizontally, and so long as

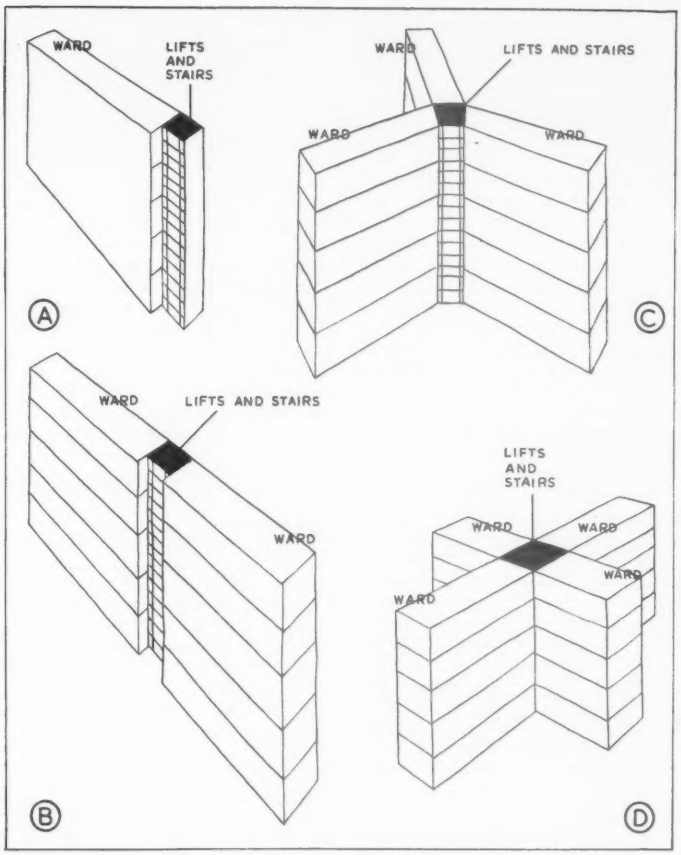


Fig. 2. Various arrangements for multi-storey ward blocks

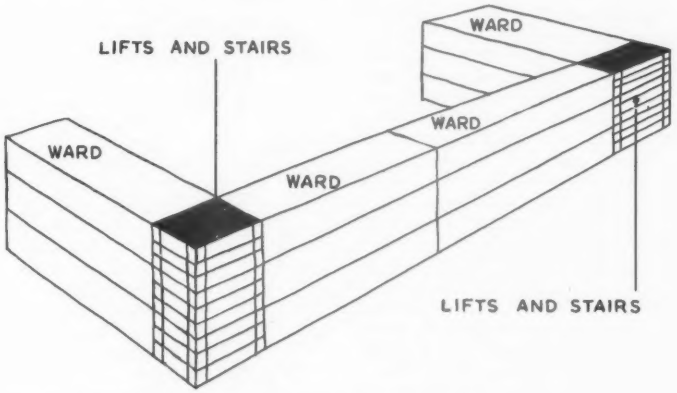


Fig. 3. Ward block with two points of vertical circulation

these compartments are provided there is no need to limit the height of ward buildings on the ground of fire hazard. Attempts have been made to relate the height of buildings to constructional cost but such studies as have been made have been inconclusive. Again, little is known about the economics of lift provision, but there are strong arguments in favour of concentrating the lifts in a single vertical shaft rather than distributing them at different points in the building. Thus a single, tall ward block is preferable to several blocks of medium height from the point of view of lift service. In practice, height is generally fixed by less tangible considerations, such as the appearance of the building on the site or in relation to neighbouring buildings and landscape. It is generally agreed that it should be an aim in hospital design to achieve a friendly and reassuring character rather than an imposing or institutional one and tall buildings have been criticised as having a terrifying effect. These are considerations which the architect must weigh, but for which rules should not be laid down.

The number of beds in the ward or nursing unit has important implications in determining the best form for the ward block. Current planning is based on a ward size of 25 to 30 beds, 28 beds being sometimes recommended as a compromise between nursing requirements and economy. Following the recent job-analysis of nursing carried out by a team sponsored by the Nuffield Provincial Hospitals Trust and the experiments in nursing sponsored by the Ministry of Health's Standing Nursing Advisory Committee, a new approach to nursing organisation is developing. This approach, which will no doubt be discussed in another paper, is based on the idea of group case assignment. Under this system of nursing, a group of beds forming a nursing unit is made the responsibility of a nursing team, led by a trained nurse, several such units being grouped together into a larger administrative unit under a sister. This approach has revolutionary repercussions for ward planning, and the Investigation's experimental ward buildings in Scotland and Northern Ireland have been designed with this form of nursing in mind. The Scottish example is based on a nursing unit of 16 beds and that in Northern Ireland on a nursing unit of 20 beds. Fig. 4 shows how four 20-bed units can be grouped on a floor, giving a total of 80 beds. This 80-bed unit need be no greater in length than would be a block containing a pair of "traditional" wards housing perhaps 56 beds. The extra accommodation can be obtained partly by compact planning and partly by increasing the thickness of the building. That greater thickness is practicable from the point of view of ventilation and daylighting has been shown by studies made at the Building Research Station.

For a hospital of given size, an increase in the number of beds per floor reduces the number of floors, and thus the total height of the ward block. For example, in Fig. 5 both blocks contain the same number of beds; one, which has 28-bed wards, is ten

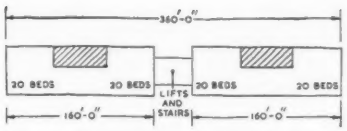
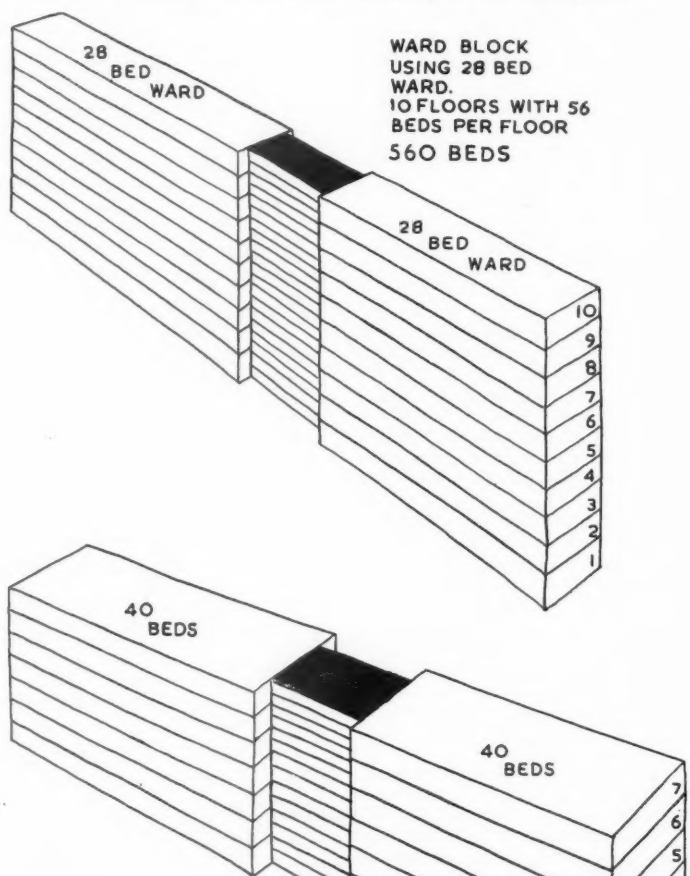


Fig. 4. Arrangement of four 20-bed nursing units to give 80 beds on one floor

storeys in height, the other, based on the Musgrave Park plan, is only seven. Of the two, the seven-storey block would cost considerably less to build, and since it has three floors less there would be a reduction in lift stations, service points and service rooms. Being more compact, it provides more floor space per sq. ft. of external wall and is cheaper to heat.

Apart from the economic advantages, the ability to place more beds on each floor increases the designer's freedom in the choice of building form. For example, arrangement B, Fig. 2, is often the most desirable. In practice its use is limited by the fact that if the requisite number of beds is provided a building exceeding an acceptable height may result. If so, the designer will be driven to accept other arrangements less satisfactory from the point of view of amenity or circulation. If, however, he can get 80 beds instead of 56 on each floor, he can accommodate many more beds within a given height limit and he may often find it possible to use arrangement B where he would not be able to do so with traditional ward planning. Similarly, the more compact ward plan reduces the spread of single-storey layout. Fig. 6 shows a comparison between two units of 140 beds, one based on the conventional ward of 28 beds and the other on the 20-bed unit, similar to that used at Musgrave Park Hospital.

Fig. 5. Two differing ward blocks each containing the same number of beds



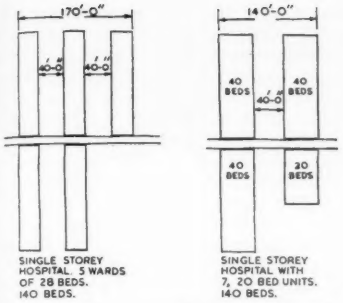


Fig. 6. Single-storey lay-outs compared

Daylighting must be taken into account in considering the shape for the ward block and its relation to other buildings on the hospital site. Strong daylight has a bactericidal effect, promotes cleanliness and makes for a pleasanter atmosphere in the hospital. It has been suggested that the daylight factor should not be allowed to fall below 2 per cent at the back of a ward. It seems reasonable to regard this as the minimum standard for all parts of the hospital. If, owing to the design of the hospital, the view of the sky is obstructed by other parts of the ward block or by other buildings, daylight penetration into the rooms will be reduced. In these circumstances good daylighting will require the use of larger windows or shallower rooms or both. From the daylight point of view therefore arrangements such as type D in Fig. 2 are undesirable. Still more undesirable is any form of enclosed light well.

Views on the orientation of ward blocks have changed with changes in the internal planning. The pavilion ward was always, or nearly always, orientated east and west, sometimes with a veranda on the south end. A report on the orientation of buildings included a section on hospitals.[3] An analysis of sunlight penetration to the 'Nightingale' ward was given and the conclusion was drawn that narrow vertical windows were unsatisfactory. The report recommended the use of much larger windows and beds arranged parallel to the windows, as in the Rigs Hospital, Copenhagen. It was assumed, however, that the wards would remain open, with windows on both sides, and east and west orientation was not criticised. The introduction of the corridor plan led to buildings with a south orientation. All the rooms for patients were commonly on one side of the corridor, facing south, with ancillary rooms on the other facing north. The South Hospital in Stockholm and the Bürgerspital in Basle are well-known examples. Both have very large ward blocks facing south, and in order to provide the wards with unobstructed sunlight and view the rest of the hospital buildings are placed to the north. The ward blocks, which are high and long, cast a permanent shadow over the rest of the hospital.

On the whole, studies made by the Investigation indicate that in an acute general hospital, patients' bedrooms need not necessarily be given priority in sunlighting over all other accommodation. The large proportion of ambulant cases to be expected today means that many patients will spend much of their time not in bed but in a day-room. Those who are acutely ill will probably not benefit greatly from bright sunlight, and indeed might prefer shade. The average length of stay in an acute general hospital is now usually so short that it is really no serious hardship if it is not passed in a south-facing room. On the other hand nurses, technicians, medical staff and others may spend the whole of their working life in a hospital and it is undesirable that the rooms they work in should face north or be in permanent shadow. It therefore appears that a broader view should be taken of orientation in hospital design, and that the aim should be reasonable standards throughout the hospital rather than that the patients' bedrooms should face south at the expense of the rest of the hospital.

It has sometimes been argued that the accommodation required in a ward building is likely to change so rapidly that the internal walls should be made demountable so that they can easily be taken down and re-erected in different positions. There is no technical difficulty in designing the structure of a ward block so that the internal walls are not load-bearing, and indeed this is done in most multi-storey hospital buildings. If the internal walls are built in a normal manner with bricks or blocks they can be demolished and re-erected elsewhere without affecting the structural stability of the building. Rearrangement will however be a dirty and noisy business and will involve closing the ward or wards affected while it is being carried out. Alternatively, various forms of prefabricated partition specially designed for easy dismantling and re-erection can be used. These systems are considerably more costly than conventional partitioning. They also present serious problems in sound-proofing. Further, any major rearrangement of the ward is almost certain to involve changing the position of the services, including electricity, water, drainage and perhaps also heating and ventilation. Alterations of these services will mean taking up the floors or taking down the ceilings. Thus the fact that a demountable partition has been used will not necessarily avoid the need for substantial building work when alterations are made. To meet this difficulty it has sometimes been proposed that ward buildings should be constructed with a uniform grid of services, all of which would be available at any point. Such an installation would be extremely expensive and at any one time only a small proportion of the outlets would be used. Generally, any attempt to provide for a high measure of flexibility by changing the walls and services in a building is likely to be very costly and can only be justified if there is a reasonable certainty of substantial changes being made at frequent intervals.

It is therefore worth considering in some detail what sort of changes are most likely to be wanted in wards. It appears that the requirements of ward planning change with somewhat less rapidity than do those for many parts of the hospital. Wards built 100 years ago are still in use today, with minor alterations. Though inconvenient they are still usable and patients are still being nursed in them. In this the ward may be contrasted with other parts of the hospital, where buildings of similar age have often been found wholly inadequate for present-day purposes and have had to be drastically remodelled. The reason for this contrast lies in the function of the ward. The majority of the nursing needs for a sick human being are unchanging. He must have a bed, there must be space round it for the nurse and the doctor to attend to him, and there must be facilities for his toilet and for feeding him.

While the needs for a sick human being and hence the space and services required in a ward may not change very rapidly, we must expect considerable changes to take place well within the life of a hospital building in the number of cases requiring admission from a given population, and still more in the proportion of these cases as between the different specialties. These changes can however be provided for by the right approach to planning and do not necessarily call for frequent alterations to the fabric of the building. In the first place wards should be designed to be suitable so far as possible to house all types of patients. With the exception of children and maternity cases there is no reason why the same ward plan should not be used for all departments in an acute general hospital, so that accommodation can be switched from the use of one department to another without structural change. This will also facilitate the temporary allotment of beds to meet seasonal fluctuations in demand. To ensure that the beds are so far as possible interchangeable between the different departments, the ward block should be sited so that all wards have equal access to the theatres, radio-diagnosis and other special facilities for diagnosis and treatment.

Studies in demand for in-patient accommodation referred to earlier in this paper show that the numbers of male and female patients in any specialty are not usually the same and that fluctuations from time to time are considerable. Hence it is wrong to design a ward block arbitrarily on the basis of 50 per cent male wards and 50 per cent female. This is bound to lead to a waste of beds. Ward design should be such as to enable the proportion of male and female beds within any department to be varied so as to meet the demand. This means that the ward should be divided into reasonably small units, each provided with its own toilet facilities. The degree of sub-division required to give the necessary flexibility will depend on the overall size of the hospital—the larger the hospital, the larger can be the unit. In a small hospital it will be best not to have rooms larger than six beds in order to give the maximum flexibility and therefore high occupation.

The Investigation has not studied the special requirements for children and maternity patients in detail, but it appears

that they are sufficiently specialised to warrant the provision of accommodation different from the normal adult ward. Where wards are grouped in a vertical building there would be difficulty in inserting a floor containing a ward or wards of a different plan in among the rest. Structural columns, bearing-walls and service shafts appropriate to the ordinary wards might not fit in with the layout necessary in the special ones. If these wards are incorporated in the main ward block the top floor will probably be found the most convenient position. Often it may be found preferable to separate either the maternity or children's wards or both from the main block. Apart from structural convenience there are other arguments in favour of this course, particularly the fact that both children and mothers are especially liable to cross-infection and the need to give these wards an atmosphere and character different from the rest of the hospital.

II. The Out-patient Department. Today the treatment and diagnosis of out-patients is a major part of the hospital's function, and the design and placing of the out-patient department is one of the most critical questions in the planning of a hospital. Growth and change have been continuous in recent years and in almost every hospital in Great Britain the out-patient department has been greatly extended or altered. Demand for out-patient care is now increasing less rapidly than it has done and it may level off, but considerable fluctuations, particularly as between the different specialties, must be expected well within the life of a hospital building. Further, methods of diagnosis and treatment are likely to progress rapidly and this is bound to be reflected in changes in the accommodation and services needed. The ability to meet changing requirements is thus fundamental to the design of out-patient departments. There has been a tendency to think of this problem in terms of the rearrangement of internal walls. While demountable partitioning may have application in certain cases, despite the problems of cost and noise, flexibility should be sought in the first place in planning rather than in special forms of construction.

An out-patient department consists of a large number of units, clinics for each specialty and special facilities for diagnosis and treatment. Over a period of years each of these will have its own problems of growth and alteration, and the plan should allow for each to grow and change so far as possible without interfering with its neighbours. This is an ideal not always realisable in practice, particularly on restricted sites. It should however be the aim. It means that the various units within the department should be related like branches on a tree, each with freedom to grow without disturbing the general pattern. Full flexibility in this sense can be obtained with single-storey construction where space is available. In a multi-storey building an important measure of flexibility is immediately lost in that it is impossible to expand a unit on an upper floor without displacing other departments in the process or extending the whole building, including the floors below. The team's studies, which will be described in detail in the Investigation's forthcoming report, suggest that a simple general-purpose consulting suite can provide accommodation for a wide variety of consultative clinics. If the clinics are designed on this principle it will be possible to allot suites to different specialties in accordance with the demand and to transfer accommodation to meet shifting needs without structural alteration. To ensure the greatest flexibility in use the consultative clinics should all have equally easy access to services such as radio-diagnosis, pathology, the dispensary and so on.

In considering the placing of the latter departments, where they serve both in-patients and out-patients, proximity to the out-patient department should be given priority over proximity to the wards, as the demand made on their services by the out-patient is likely to be greater than that arising from in-patients. The out-patients should be able to make their way from the consultative clinic to the special departments by a route as short and direct as possible.

The majority of patients make their first contact with the hospital as out-patients. A visit to the out-patient department precedes admission to the wards, except for casualties or emergency cases. The out-patient entrance should therefore be regarded as the front door of the hospital, with the wards and other departments behind or to the side. It is undesirable for out-patients to have to pass through the ward buildings or other portions of the hospital in order to reach the clinics or such departments as X-ray diagnosis or pathology. Where departments serve both in-patients and out-patients the best position is between the out-patient clinics and the ward block, so that out-patients reach them from one direction and in-patients from another.

III. The Operating Theatre. On the whole, in recent years the proportion of theatres to beds has tended to increase. Provision should therefore be made in planning a new hospital for adding to the number of theatres without disturbing the rest of the accommodation. The theatres can either be grouped together or, as was often done in the past, they can be dispersed and placed close to the wards they serve, e.g. there would be theatres for general surgery adjacent to the surgical beds and a theatre or theatres near the gynaecological ward and near the eye and E.N.T. departments. The principal advantage of this arrangement is that the journey made by the patient from ward to theatre and back again is short. On the other hand, dispersed theatres have many disadvantages. More theatres will be needed if every department has its own; and many departments may have insufficient operations to make full use of their accommodation. Single theatres are more expensive to provide than paired theatres, which are able to share a great deal of the very expensive ancillary accommodation and services. It will be very costly to provide air-conditioning, piped anaesthetic gases and oxygen at a number of dispersed points about the hospital. The control of asepsis is likely to be more effective in a centralised operating department, where one highly experienced theatre sister is in charge.

Perhaps the strongest argument against dispersed theatres is that it is impossible to foretell exactly which wards will be occupied by surgical cases over a period of years. If a hospital is so designed that all wards have good access to a central group of theatres, then the maximum flexibility in the allocation of beds is ensured. Theatres can be grouped either horizontally or vertically. The vertical arrangement has the advantage that the supply from a central sterilising department can be arranged by direct lift to all theatres. Further, it enables theatres to be connected on the level with a number of wards in a vertical ward block. Horizontal grouping has the advantage that it makes for easier control by a theatre sister over a number of theatres and can also provide for easy extension.

The provision of recovery rooms within the theatre suite is an important issue. Clearly, centralised theatres may be some way from the patients' beds and provision for some cases to be held back, after operation, in a recovery room within the suite will be desirable. On the other hand it is not certain that recovery rooms can be dispensed with where a theatre is fairly close to the ward. The purpose of a recovery room is to ensure that patients whose condition warrants it are kept under the eye of the anaesthetist and that full resuscitation equipment should be immediately available. These needs would not necessarily be met by moving them to an ordinary ward even where it is quite close to the theatre. Once the provision of recovery accommodation within the theatre is accepted, then the need for the theatre to be immediately adjacent to the ward becomes less.

The balance of advantage would seem to be with centralised rather than dispersed theatres for major in-patient surgery. In addition a minor theatre or theatres should be provided in the casualty or out-patient department.

Conclusion. The foregoing discussion derives from my experience as a member of a research team which included a doctor, a nurse, a medical historian and others. Perhaps the most important single lesson learnt from this experience has been that hospital design problems can only be solved by this sort of co-operative thinking. While research such as that on which I have been engaged can contribute general ideas and methods of approach, every hospital is and must remain an individual problem in design. The arrangements by which architect, doctor, nurse and administrator can best co-operate in the design of a hospital are worth discussion and I hope that they will be touched on in other papers.

In this connection I would like to stress the importance of the stage which precedes that of design—that is, when the programme is being drawn up. It is at this stage that the success or failure of most hospital projects is determined. It should be entrusted to a small group of senior people, and in the case of a hospital of any size some at least of them should be able to devote a major part of their time to the work. Too often in the past the drafting of a hospital programme has been thought of by hospital authorities as something which could be accomplished at odd moments by an officer already burdened by routine duties. A slipshod programme is likely to result in enormous waste of effort and money, disappointment for the hospital authority and frustration for the architect, who is driven to prepare schemes which later must be drastically re-modelled or even abandoned when the inadequacy of the programme is discovered. Hence time and money spent at the programme stage is very well worth while.

The time involved will naturally depend on the size of the project, but for a hospital of any size may well be one or two years. It may be necessary to carry out a survey to discover the demand, as was done for the new hospital at Dundee, and it will certainly be necessary to collect statistical information as to the working of the existing institutions which the new hospital will supplement or replace. It will be necessary to investigate waiting lists and to measure the time taken in carrying out the various services which the hospital is to provide. It will be necessary to consider many questions of organisation and administration and perhaps to arrange for experiments to be made in existing institutions in order to try out new methods of working which are being considered.

The programme should not be thought of as something prepared by the hospital authority and then handed over to the architect to design from. Co-operation between the architect and his hospital colleagues should be continuous at all stages. The architect has a contribution to make at the programme stage and he needs the help of the doctor, nurse and hospital administrator while he is developing the design.

I have tried to give you some idea of the architect's contribution in these fields. Other speakers will be giving you the viewpoints of the medical and nursing professions.

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The General Design Problems of the Hospital

By M. E. Molander, Director, Central Hospital Planning Bureau of Sweden

Read at the R.I.B.A. Hospitals Conference 21 October 1954. Mr. J. H. Forshaw, C.B., M.C., M.T.P.T.I. [*F*] in the Chair

THE GENERAL DESIGN PROBLEMS of the hospital can be defined in different ways and from different angles according to the point you start from. You may start from the point where everything of basic programmatic nature is already settled, i.e. from an already fixed programme in which the demands are defined in number of beds, number and size of rooms, communication schemes and so on. In this case the general design problems will be more or less limited to the purely technical and architectural sphere. These problems are difficult enough and they need an experienced and gifted architectural and technical staff to be solved successfully.

If you, however, start from the very beginning, from analysing the demands upon the hospital, the field widens and you meet problems of a different nature but of a major importance.

The Demand For Hospital Beds. In my country we have had a regional or hospital area system since 1862, with fairly well-defined boundaries. We also have had during the last 20 years uniform hospital statistics, which have enabled us to follow the trends and developments in the demand for beds in a satisfactory way. Thus hospital statistics are of fundamental interest and importance for the planner. He must keep himself informed continuously on current hospital statistics both on a national and international level, and he must know how to make use of them. These statistics will give him hints about the trends in the average stay for different specialities, the development of the X-ray speciality as regards the number of examinations per patient in hospitals of different kind and structure, the frequency and variety of operations and the tendencies within this sphere of activity, etc. This does not only give him material for the dimensioning of the hospital and its different facilities, but also views on the actual planning with regard to the further development of the hospital and its departments.

With access to hospital statistics of this kind the demand for hospital beds for different purposes can be estimated with a certain accuracy. The general material on national or regional level, however, must be confronted with the local experience so that all special conditions are taken into consideration.

As a rule the growth of the population cannot be foreseen in detail or for a considerable time, but a population prognosis is necessary at least for the nearest ten or fifteen years. It is often very difficult to go further, but the general tendency is worth knowing, i.e. if the population is increasing, decreasing or stable. In this respect one has to communicate with town planning authorities and population statistics offices.

For a more detailed planning it is necessary to know the composition of the population, above all as regards different ages. In regions with expanding cities and towns, younger people will move in. The old will be proportionately fewer, and the children more numerous than in areas that stagnate. This is of importance as both old people and children need more hospital care than others. The need for pediatric beds, furthermore, varies considerably with the composition of the children age-classes. Therefore the estimation of the need for pediatric beds demands a far more detailed investigation and prognostication than for other categories. Special consideration also has got to be paid to the rather rapid changes that take place in the demand for pediatric beds owing to variations in the composition of the children age-classes.

For ordinary hospitals the influence area can be defined by a survey of the domicile of the in- and out-patients. For highly developed university hospitals this is a more difficult task, but it can be carried out with a satisfactory result.

There are, however, other more irrational features that can play you tricks, for example the attractiveness of the hospital or the lack of this quality. This may be due to a certain doctor, a certain speciality or to rather undefinable idiosyncrasies. It sometimes happens within a hospital area that people from a certain town with a good hospital are overcrowding another hospital at quite a distance, while their own hospital has a very low occupancy figure. This means mismanagement and waste of money and the hospital authorities are faced with a difficult problem. The easiest way would be to forbid people to use other hospitals than the ones they "belong" to. This, however, is never done as the free choice of

doctor and hospital within the region is considered sacrosanct and its abolition would give rise to vehement general indignation.

As a rule the settling of the demands requires a survey over the whole region or hospital area to which the hospital belongs, and for certain specialities a national survey. This is rather self-evident nowadays, as modern hospital organisation depends upon the co-operation of hospitals of different degree of specialisation in order to provide the greatest possible medical efficiency. In addition to this, hospital costs play such an important political-economic role that an integrated planning is necessary.

The Size of the Hospital. In all countries with a modern hospital system every hospital is assigned a special task within the organisation. The general differentiation is in principle the same in all those countries, and it may be sufficient to mention that hospitals range from highly developed, specialised regional centres with medical schools to mere cottage hospitals or periphery health-centres with some beds attached to them. The size of the hospital more or less depends on the task thus assigned to it. Views on the most efficient and economical size of a hospital must, however, play a certain role when planning the regions.

Many views have been expressed upon the optimum size of the hospital. Several doctors and administrators have mentioned a figure of 500 to 800 beds with a tendency towards the lower figure. It is, however, impossible to judge directly from the actual costs per day or per patient. A more differentiated hospital with fairly small, heavily specialised and staffed departments has got to be more expensive than a fairly simple hospital with just surgery, medicine and radiology, because of the difference in the tasks assigned to them. In order to throw some light upon this problem an investigation has been carried out by the State Committee on Hospitals in my country, and it may be of some interest to give a short summary of this investigation.

The committee found that the costs per day or per patient did not give any clue to the problem. A comparison between the number of employees per bed showed a definite minimum for hospitals with 400 to 500 beds. The same objections could, however, be raised against this comparison as against the one regarding the costs, namely, that hospitals fulfil such different tasks that a direct comparison of this kind is misleading. It is only natural that larger and more specialised hospitals should need more staff than simpler and smaller ones. Therefore the committee concentrated its attention upon the services outside the medical departments, not to any great extent influenced by the medical work within the hospital. A survey, leaving doctors, nurses, sisters and medico-technical staff of similar kind out of consideration, showed that the tendency towards a definite minimum between 400 and 500 beds remained. The result is demonstrated by the graph (Figure 1). The top line concerns the administration and service departments

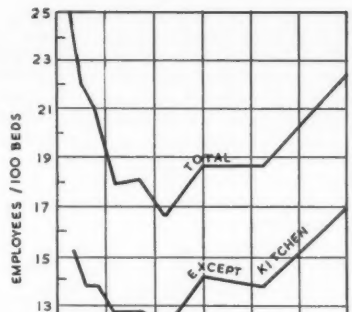


Fig. 1. Number of general services staff, except laundry, at hospitals of different sizes

except laundries, and the lower line the same services except both laundries and kitchens.

The investigation, which covered 97 hospitals, seems strongly to support the views on the optimum size of the hospital referred to previously. It is somewhat astonishing, anyhow, that the minimum is to be found below 500 beds.

It is not possible to go into details, but it ought to be mentioned that the values on which the graph is based seem to be distributed in a satisfactory way from a statistical viewpoint.

In order to control the representativeness of the hospitals as regards their general effectiveness, the turnover of in-patients per bed and year was correspondingly looked into. The result showed that the highest number of patients per bed and year was to be found at the very hospitals with the minimum staff per 100 beds.

The Demand for Flexibility and Expansion. Even if the hospital is given a special task within a region, the future cannot be foreseen. The activities of a hospital are changing gradually owing to the development of medical science and modern technique. The hospital, therefore, has got to be planned to meet also future demands that cannot be foreseen at the stage of actual planning. This leads to a compromise between the very precise and logical solution that can be derived from conditions for the time being, and the rather vague picture of future demands.

For the moment you may be able to state, with some accuracy, that for instance X-ray departments and laboratories will grow rather fast. You can figure out the probable further differentiation of, for instance, general surgery and general medicine. At the same time even a rather short experience in the hospital field will tell you that very often you will be overtaken by progress. This is the more embarrassing as it occurs during the carrying out of the plans and while the hospital is being built. This is a drastic illustration of the rapid changes that take place in the hospital field in these days, above all at the more specialised hospitals.

This underlines the need for flexibility in regard to the size of the hospital and its different departments. It also emphasises the importance of a skeleton plan for communications and extensions beyond present plans and to a very great extent affects the choice of building site, which has to provide room for further development.

Hospital wards form a fairly stable element in the hospital and are very much alike, even if they serve different purposes. Departments like operating theatres, laboratories, radiology, etc., serve very different purposes and have special demands for elasticity, above all as regards expansion. The wards in general have the same demands for insulation, lighting, ventilation, sound-proofing and quietness. This indicates the technical and economic advantages of concentrating the wards in special ward-blocks and diagnostic and therapeutic departments in special blocks. This not only makes it possible to cultivate the plans for the wards and other departments in conformity with their special needs, but also provides conditions for a natural architectural variation and articulation.

Even if you compromise very often and with good reason in regard to this, I have a very strong impression that it remains one of the principles that lend a hospital consistency, technically and architecturally.

As regards elasticity, the main problem primarily is one of planning, i.e. to provide means for further expansion. This, however, does not render the choice of a fitting constructional system a minor problem. Above all this applies to the diagnosis and treatment blocks, where the need for flexibility is far more prominent than in the ward blocks. In my opinion it doesn't pay to go to extremes in flexibility in order to provide any possible demand that might occur. Among other things, this involves the provision of a grid of technical fittings and installations of which the main part will never be used.

A rather ordinary skeleton construction, at least for more considerable buildings of this kind, seems quite sufficient. This construction may be combined with outer walls made of bricks, in which case special attention has to be paid to the average size and distribution of windows best suited for the different purposes the building has got to serve. This involves a great many problems, for instance the compromise with regard to the size of the rooms and the place of the windows within them. The best solution seems the skeleton system with an outer wall panel, carried by the skeleton construction, in which case the space between the pillars can be divided more closely according to the demands.

Technically this is quite possible, but demands a very qualified architectural adaptation to prevent an impression of a monumental general disorder. The eye calls for visual order, which is one of the main elements of architecture, and this may be brought about by emphasising the skeleton system and using it as an architectural element, thus attaining visual stability.

Owing to maintenance difficulties caused by the climate, this system has certain

disadvantages in my country and has been applied on rare occasions only.

The Ward-Units. After long consideration and after a thorough study we are not ready to abolish the 30-bed ward as the general model. We have been able to prove that smaller wards are more expensive to run (see my paper at the Building Research Congress 1951),[1] but there has been no material available to prove that bigger wards would be more advantageous in our country. I can briefly say that medical, administrative and architectural considerations brought us back to the 30-bed ward as being the most convenient one.

In order to attain the greatest possible flexibility and capacity as regards occupancy, the ward-units nowadays usually are designed to make possible admittance of both male and female patients. This is of a certain importance, especially in departments with a limited number of beds or with an odd number of ward-units. It is also a reason for having separate rooms and not open wards, although the latter no doubt facilitate the work to a certain degree.

Six-bed rooms have been considered the maximum, but there is for the moment a tendency towards accepting also 8-bed rooms.

The number of patient rooms of different sizes very much depends upon the demand for isolation rooms. The Investigation into the Functions and Design of Hospitals, sponsored by the Nuffield Provincial Hospitals Trust, has made an investigation about the need for isolation rooms which has given a rather definite answer to this question. We have carried out a similar investigation, based upon nearly the same principles, i.e. we have adapted them for our conditions and for our somewhat different way of approach. The investigation covered 29 hospitals and 60 per cent of their medical and surgical wards. In the Swedish study the judging of the needs was made by the sister in charge of the ward, according to certain rules laid down in advance. In the English study the needs were judged by medical men, and our results may be of a certain interest as corroboration (Table I).

The English investigation gave a total of 29 per cent in medical wards and 19 per cent in surgical wards, and the results arrived at in different countries and with a somewhat different approach thus seem to correspond astonishingly well.

We have not been able to work out the results in more detail as to the variations in occupancy, etc., and the average figures applied directly, without any such considerations, would give the distribution of the isolation rooms as in Table II.

In surgical departments not less than 8 per cent of the patients needing isolation room were post-operative cases, which has to be taken into consideration in case a special post-operative department is arranged.

In my paper at the Building Research Congress 1951 I gave some views upon the traffic frequencies within a ward-unit and their influence on the planning and on the location of the sub-localities. In the same paper also appeared a study of traffic frequencies to ward rooms of different sizes, showing that smaller rooms, as such, automatically increased the traffic load and work within a ward-unit. There is no need, I believe, to refer to these studies in more detail as they are available in the Congress Report.

[1] 'Some Views on Hospital Planning and Research.'

Table I.

Ward	Percentage of patients per day needing care in		
	1-bed room	2-bed room	1- and 2-bed rooms (total)
Medical	13·17	15·58	28·75
Surgical	7·34	11·34	18·68
Thereof post-operative cases ..	1·13	6·64	7·77

Table II.

Ward 30 beds	Number of		
	Isolation beds	1-bed rooms	2-bed rooms
Medical	8·6	4	2–3
Surgical	5·6	2	2

A hospital cannot be constructed from mathematical or other formulae, but it is valuable to know to some extent what the alternatives you are faced with mean from the running point of view and as regards heating, maintenance, etc. This can only be done summarily at the design stage, but I will give an example, showing that fairly small variations can be calculated to this effect if you have access to some basic figures.

It is a comparison between two 30-bed ward-units with identical suites of sub-localities and isolation rooms where four 6-bed rooms were substituted for six 4-bed rooms.

The alternative with six 4-bed rooms instead of four 6-bed rooms would need a little more space. The outer walls would be slightly longer and you would need more windows and some more sanitary and electrical fittings owing to the increased number of rooms. The additional costs per year could be estimated as follows:

	£
Annuities (4 per cent)	45
Amortisation (40 years)	10
Maintenance	17
Heating	14
Total for the localities ..	£86

The same alternative would give 1·5 miles longer walking distance a day (except night staff), which means 35 minutes a day. Additional work for cleaning was estimated at 15 minutes a day. Based on an average pay of 5*s.* 6*d.*, including so-called social costs (pension, etc.), this makes an additional cost of £84 a year.

The costs pertaining to the localities (£86) and to the running of the ward-unit (£84) are rather small, but when they are repeated for a number of units they will assume a greater importance in view of the very slight variation they represent in the lay-out of the ward.

For ten units of the same type the additional costs for the localities only would be £860 sterling yearly. If it is possible to make full use of the difference in working-hours, the additional costs would rise to £1,700 sterling a year.

You may or you may not accept this additional expense as fully corresponding to the value of having six 4-bed rooms instead of four 6-bed rooms, but you must know that hospital economy to a very large extent lies in collecting seemingly insignificant gains over the whole field and not in some unique trick.

In order to avoid the embarrassment of transporting oxygen tubes, especially at night, which is rather costly as it requires extra porters, the tendency is to provide the isolation rooms within the ward units with oxygen taps served by an oxygen-centre, usually in the basement. This requires some care at planning in regard to fire-precaution as the tubes in the oxygen-centre may have to be brought out in case of fire. A consequence of putting up oxygen taps is a rapid rise in the consumption of gas, now so easily available.

Dimensioning the ward-rooms, we consider a distance of 3 ft. between the beds sufficient. The provision of smaller rooms for isolation purposes in our country roughly corresponding to the figures mentioned in the foregoing, no need of screening the patients within the bigger wards has been expressed. The bigger wards need a space of 75 sq. ft. per bed, made possible by the fact that no special working-space around a fully screened patient is necessary. In this case the 3 ft. between the beds is found sufficient for at least 90 per cent of the work regarding the patient in his bed. Moreover, the beds are as a rule equipped with wheels and are easy to move if needed.

With regard to our climate, we cannot

rely on windows only for ventilation, and using artificial ventilation we can limit the ceiling height to a maximum of 10 ft., which also has proved a sufficient figure for other departments.

Operating Departments. There is always some risk in generalising on hospital needs and demands. There are, however, many conditions that are similar or identical at a big number of hospitals or departments of a certain type. A hospital also has to be designed, not for a certain individual but for conditions that suit different individuals who may happen to work there. Therefore, a knowledge of average conditions is necessary and useful as guidance, but it must be based on sufficiently extensive material.

Some doctors are very rapid operators, others are not. An investigation in my country covering eleven hospitals during three weeks (21 days) makes clear, however, that certain outlines can be derived from material of this range, in spite of dissimilarities of the kind just mentioned. The investigation concerned general surgery and was carried out at departments chosen with a view to comparable conditions in regard to patients, medical standards and so on.

The investigation showed that the effective operating time per operating room could not be longer than 4½ or 5 hours without considerable drawbacks for the work in the surgical department as such. The average time for each operation was 1½ hours and the rooms could be used for planned operating programmes about 260 days per year. This means that each room could be used for about 1,000 operations a year. This capacity, however, cannot be brought about if the theatres are not supplied with a sufficient number of localities for the patient before and after the operation. The need for special localities for endoscopy, fractures, emergency cases, etc., also has got to be taken into consideration.

The work in surgical departments is characterised by the steadily increasing number of more laborious operations. Figures from 13 surgical departments show that operations concerning the gall bladder have increased from 44 per 100 surgical beds in 1938 to 172 in 1950. At the same time there is a marked tendency towards longer operations as, owing to modern achievements, swiftness does not play the same role as formerly. This tendency supposedly will be more accentuated in the future.

Two operating rooms can be regarded as the minimum requirement for a surgical department, as one of them must always be ready to receive acute and emergency cases.

The number of operations corresponding to 100 beds can be estimated at about 2,000 a year, and 10 to 25 per cent of them will occur as acute cases and emergency cases outside the planned daily operating programme. The round figures mentioned do not include minor operations, blood transfusions and the like.

The introduction of anaesthetists' and post-operative departments has actualised the problem of central operating departments. Some years ago not many were in favour of them but they now seem to be generally accepted as more effective from the medical point of view.

In a central operating department general services can be rationalised and economised, and the staff on duty more efficiently made use of. It does not mean, however, that the number of operating rooms can be drastically cut down. Only specialities with a limited number of beds and patients can be assumed to share operating theatres with other specialities. It is sometimes suggested that the localities could be more effectively made use of if only the doctors would change their habits and work by shifts. This sounds clever but there are some weighty objections. The rhythm of the work has got to follow the day-rhythm of the patients, whom the hospital is meant to serve. The doctor, among other things, also is concerned with the patients arriving at or leaving the department, which has to fit in with the work on the wards and cannot be done at any time. The day-rhythm of the patient, finally, sets limits to the time during the day when it is advisable —from physiological and psychological reasons—to operate on him.

One very strong argument for the establishing of central operating theatres is the continued differentiation of surgery into separate specialities, each mastering a detail of the human body. Central operating departments very likely will bring about more close co-operation for the benefit of the patient, who represents those very interesting details.

For central post-operative departments the number of beds can be estimated as 40 or 50 per cent of the average daily number of operations.

X-ray Departments. For ordinary general hospitals in country areas, the number of X-ray examinations can be calculated to be about 50 per bed and year. In these areas the proportion of out-patient examinations will be about 40 per cent of the whole number of examinations. For ordinary hospitals the combination of various examinations is about the same, and departments serving hospitals of this kind therefore can be planned along the same lines.

Three X-ray rooms for radiography or fluoroscopy and one X-ray room for urology is considered sufficient for 25,000 examinations a year. The X-ray rooms contain two and occasionally three apparatuses. It is important that the X-ray rooms have almost direct contact with the dark-room in order to save work.

Developing machines now have come on the market and seem promising, but they are still rather bulky and require more space than formerly was used for developing purposes.

It may sometimes be convenient to split bigger departments in two halves, situated on different floors and with viewing-rooms, offices, etc., in a storey between.

In the CSB, the Central Board on Hospital Planning to which I am attached, a special investigation is being executed concerning the details of the X-ray work. We are trying to get average times for typical examinations, values for the exploitation of the different apparatus, etc., and views on how the staff is involved. The investigation also will show the patient's waiting time. This investigation is rather complicated and has been carried out at one hospital only. It is to be considered as a pilot survey, and we hope to be able to find some significant trends or facts to concentrate on for further investigations.

The X-ray department has to be planned with a special view to the possibilities of expansion. If the X-ray examinations cannot be executed according to demand, the stay of the patient will be prolonged, the costs per patient will rise and the capacity of the hospital will be lowered.

Considering the special need for effectiveness in X-ray departments, it is my opinion that one must not pay too much regard to existing conditions when remodelling an X-ray department. In the long run it will pay to make the best possible solution even if it causes rather drastic alterations and spoils existing costly arrangements.

There is a great need in my country for spacious viewing-rooms, as each day the doctors from different departments come together for a so-called X-ray round, when the films are gone through and the cases are discussed. New viewing-boxes have been invented which can store a considerable number of films put up for demonstration.

The X-ray records need spacious filing-rooms even if they are kept for ten years only. A cupboard 3 ft. wide and 7 ft. high would keep about 3,000 examinations. A 500-bed hospital with 25,000 examinations yearly needs at least eight such cupboards, and consequently for ten years 80 cupboards. Arrayed in a row they would stretch 240 yards. There are modern storing systems available that save space, but they are fairly expensive as they rely on electro-mechanical devices. Usually the demands in this respect are neglected or underestimated, as are these for a good location with regard to X-ray department and medical records office.

Central Kitchens. The central hospital kitchens in my country are generally situated in a separate building together with the staff restaurants. We have tried in some hospitals to have the kitchen in the main building, even on the top floor. The results are not so good, as the kitchen fairly often has to be rearranged and extended, according to the growth of the hospital.

The traffic to and from the wards is regular and can be organised in detail, according to a time schedule. Because of that we do not pay so much regard to a marked central position of the kitchen. The central spaces, furthermore, are considered more useful for services in close connection with the patient and the medical work.

A study of the temperature of the food on its way from the kitchen to the patient's plate, recently carried out at several hospitals, has made clear that the transport is of minor importance for the fall of temperature that affects the food before the

patient gets it. Even very long outdoor transport in primitive trolleys during winter could not match the temperature lost in the kitchen between the stove and the trolley and, above all, during the distribution in the wards.

This indicates that a more or less central position of the kitchen does not affect the quality of the food, and that the temperature fall has got to be fought within the kitchen and the ward-units.

A study appearing in my paper at the Building Research Congress 1951 showed that according to our conditions bigger central kitchens need less staff per day-portion than smaller ones. At a size of 100 day-portions a day (breakfast, lunch and dinner) every staff-unit can produce 18 day-portions a day, at 300 thirty, and at 800–900 nearly forty. The study also showed that it is unlikely that a kitchen exceeding the last-mentioned size will achieve any greater effectiveness. A figure of 800–900 day-portions roughly corresponds to 650 beds.

The study also showed that the demand for space, counted per produced unit, is far greater in small kitchens than in larger ones. It is evident, also, that the space cannot be more effectively utilised in kitchens with more than 900 day-portions.

If you combine these observations you will find that, as far as general hospitals are concerned, probably no advantages worth mentioning will be derived from a central kitchen exceeding a capacity of 900 day-portions, neither with regard to the staff nor considering the capital costs.

Laundries. When planning hospitals over a hospital area or a region, the organisation of the laundries has to be considered. Formerly, when labour was cheap and efficient laundry machines were lacking, there was no need to centralise the laundry work. High wages and modern equipment have entirely changed these conditions and made centralisation possible and profitable.

As a member of a Committee for the Enlargement of Mental Care I have taken part in an investigation about the laundry services, and I will give a summary of some of the results arrived at.

Figure 2 shows the differences in costs at laundries of different sizes. It is evident that considerable savings can be made by changing over to centralised industrial laundries. As can be seen, the maintenance of a system with several small laundries must be very expensive. For small laundries serving only 100–200 beds, i.e. with a day-capacity of less than 0·5 tons, the costs are about 100 per cent higher than for large-scale centralised laundries.

The washing per patient in a general hospital amounts to about 4 lb. weight per day, which corresponds to 0·6 tons a year per bed. For a small hospital with a laundry of its own the centralisation may bring about savings amounting to £30 or £40 sterling per bed yearly. For a 100-bed hospital this means £3,000–£4,000 sterling a year, a considerable sum. By cutting down the number of laundries serving several state and other institutions in my country—

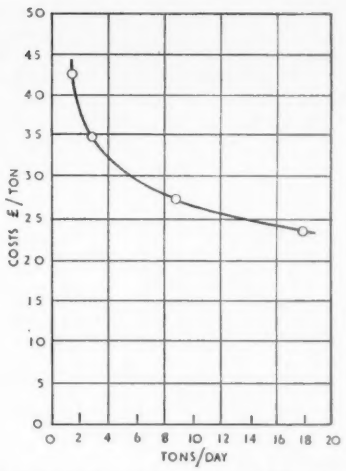


Fig. 2. Costs/tons for laundries of different sizes (except transport)

among them the state mental hospitals—from 67 to 12, savings estimated at £275,000–£350,000 yearly are expected.

Even in our very sparsely populated country with widely dispersed hospitals, transport costs are of secondary importance and do not amount to more than £2 per ton, on an average, for the bigger laundries.

A centralisation of this kind of course leads to an enlarged linen supply, which however is a non-recurrent cost of minor importance.

The twelve laundries planned to replace the 67 now in use would range from 1 to 21 tons' daily capacity. The average daily capacity would be about 12 tons. A laundry of this size roughly corresponds to 6,000 general hospital beds. We already have some experience from centralised laundries of this type and it is positive as regards the quality of the work. Initial difficulties at the changing over to a centralised service are to be expected before it is running smoothly with a well-trained staff.

The laundries are intended to be run by a joint-stock company 'State Laundry Industries Co. Ltd.', with representatives of the different clients on the board.

It is not my intention that the hospital designer shall start laundry companies whenever he is faced with a laundry problem, but co-ordinated hospital services means co-ordinated hospital planning and co-ordinated planning means attacking problems on broader lines, using the joint resources.

The Co-ordination of Different Departments. With regard to the co-ordination of the different departments within the hospital, special interest must be paid to operating department, X-ray department and pathological laboratory. They constitute a key to the planning and organisation of the hospital.

In central general hospitals in my country nearly 60 per cent of all errands and transport carried out by the staff between different departments within the hospital have regard to operating theatres, X-ray and pathology. Of these errands and transport 60 per cent are composed of errands or transport between the ward-units and the departments just named.

These figures underline the importance of special attention being paid to the departments in question as regards their location. Even if the traffic between out-patient clinics and these departments cannot be compared with that from the ward-units, it has to be carefully planned (on an average three times as many out-patients as in-patients a year). In order to facilitate the work within the out-patient clinics and with a view to medical co-operation within the hospital, a close connection between the out-patient clinics and the departments just mentioned is desirable.

One may say that the operating department, X-ray department and pathological laboratory form the centre around which other departments group themselves from the point of view of planning. The ward-units, on the other hand, and the patients within them represent the centre of gravity in hospital work.

The operating department almost entirely serves the in-patients, the pathological laboratory to 80 or 90 per cent and the X-ray department to about 60 per cent. Of all transport and errands carried out by the staff, two-thirds to three-quarters have regard to the ward-units. Therefore the need for a very close connection particularly between medical and surgical ward-units and the said departments is obvious. The need for such a close connection is the more important as a great many patients in bed are transported to operating theatres and X-ray. According to our studies, about 50 per cent of all errands between wards and operating departments are made up of patient transport. Between surgical wards and X-ray, 55–85 per cent of the errands were made up of patient transport, and between medical wards and X-ray 60–70 per cent.

I have tried to make an index for transport and errand frequencies regarding the ward-units in a central general hospital in order to get a sort of graduation. The material at my disposal has not been so large, but has in principal matters been sufficiently in accordance. I have chosen as basis (100) the frequencies from a surgical ward-unit to the central kitchen, a fairly stable figure.

If medical and surgical ward-units are looked at together, which is convenient for practical reasons, the following approximate graduation is obtained.

Pathology	110
Central kitchen	100
Operating department ..	80
X-ray department	80
Baths and patients' lockers	70
Medical offices—out-patient clinics	70
Administration	25
Pharmacy	25
Boiler-house, etc.	20
Central store	15
Laundry	10

This table is intended to throw some

light upon the connections between the wards and different departments. Many other views are to be considered but the table may serve as guidance.

Conclusion. I want to stress the point that there is no formula solving a hospital design problem. Hospital design is characterised by a matching procedure, where premises and solutions influence each other reciprocally. So much depends upon the architect, and the more he knows about basic problems of the kind I have presented here by some examples the better can he master this matching procedure, to the benefit of the final design.

Many questions, however, are unsolved and not sufficiently looked into, and there is a wide scope for study and research. There is no risk of our outstripping hospital development, which—luckily—will give ample room for stimulating and happy ignorance in front of every new problem.

The Hospital from the Nursing Point of View

By Theodora Turner, A.R.R.C., S.R.N., S.C.M., Diploma in Nursing, University of London. Read at the R.I.B.A. Hospitals Conference 22 October 1954. Mr. Maxwell C. Tebbitt [*A*] in the Chair.

Introduction. In the past the architect planned the hospital, the medical staff approved of the plan, and the nursing staff worked while the patient suffered for 24 hours a day in the finished product. This is not true today, but still, it does happen occasionally—that is why I feel particularly honoured at being asked to address this distinguished audience.

The comfort of the patient and the convenience of the nurse are so interrelated that this paper should cover points affecting the interest of these two largest resident bodies in the hospital world.

It is very difficult for an untrained mind to assess a plan. It is one thing to look at a piece of paper and quite another to jump from cupboard to steriliser, to trolley and back, wishing all the time that the man who planned the room had known the type of procedure which would be carried out within its four walls, but the nurses are learning to criticise a plan and an increasing number of architects to understand the practical working problems of a hospital.

In some places where new types of wards or departments are to be built an experimental unit, or 'mock-up', is put up and actually used before the new building is started. In the Birmingham region they have built a 'mock-up' of a theatre unit, and though the surgeon may not operate on a true patient all other emergencies can be enacted. If there is space, opportunity and money, this type of experiment is very useful. A good model is helpful but not quite so effective.

The Problem of Size. One of the first problems to face is that of size. It is true to say that a hospital is built with a view to the requirements of the population of a particular locality, but it is not necessarily a good plan to put up a 2,000-bedded hospital merely because the city is a large one. Mr. Molander in his paper does not mention the Southern Hospital in Stockholm, but gives many excellent reasons why a smaller unit is more economical.

It is difficult to retain one's individuality in a 2,000-bedded hospital; when a man is sick he is very important to himself and to his relatives; and it is not good for him to feel small and insignificant; it does not give him faith in the hospital, nor help to build up a sure hope of recovery. A small point, but one which can give comfort to the sick man, is the visit of the Matron or Assistant Matron. To be known personally by someone in authority gives a feeling of security to a patient, and in a very large hospital, where there is a large administrative staff, it is not possible to know the sick individually.

From the nursing angle also it is difficult to administer a very large hospital. There is more likelihood of misunderstanding between wards and departments, but if the staff know each other well the personal relationship will smooth out the problems. It is very important for a matron to know her staff personally. If the sisters, staff nurses and students can rely upon the support of someone they know it gives them a sense of well-being and security. It is necessary for the staff, as well as the patient, to feel secure. In a large building the sense of unity is hard to build up and harder to maintain. A hospital of 600–800 beds as a maximum, from both the patients' and the nurses' point of view, is more comfortable than a 2,000-bedded hospital, and probably a happier institution.

Individual Departments. *Wards.* The grouping of wards into ward blocks varies in different countries, but the arrangement can affect quite considerably the number of nursing staff required. If there were plenty of nurses the architect could group the wards more or less as he liked—and there could be much smaller ward units; but there are very few hospitals in the United Kingdom with a comfortable supply of nursing staff, and we must be practical and face facts. We do not want to be too pessimistic over the shortage of nursing personnel, but it would be a bad policy to shut our eyes to it and build with the hope that the numbers will increase in the next generation or so. It is very frustrating and bad for recruitment to try to staff a beautiful building with inadequate numbers. Therefore, when grouping wards it is wise to choose the types of arrangement seen in Fig. 2 B, C, or D.[1] These three designs lend themselves to a system of combined supervision. For example, when the sister of one unit is off duty, her opposite number can supervise both wards. Also, on night duty, the number of trained staff is limited; again, it is better to have the wards grouped together and not separated by various departments, as in the case of some hospitals. The speed with which a night sister can get to the bedside can affect a patient's life.

The size of the ward is so controversial that I can only give a personal opinion, but some of the figures given by the Nuffield Provincial Hospitals Trust in the report on the Work of the Nurses in Hospital Wards are very illuminating. In the hospitals investigated, the overall staff/bed ratio stood at 1 : 2. In a small ward of 10–19 beds the staff/bed ratio was 1 : 1·3. In a large ward of 30–39 beds the ratio was 1 : 2·3. In these instances the staff included day and night nurses, domestic staff and orderlies. If the student nurses only were counted in a nurse/bed ratio this varied from 1 : 1·3 to 1 : 4·8. I will remind you here that this investigation revealed that 75 per cent of the basic nursing was done by the student nurse. I quote these figures to illustrate the staffing problems in different hospitals and localities. A popular hospital in a popular locality is naturally fairly easy to staff, and when planning a new building the recruitment facilities must be taken into consideration before the ward unit is designed. These figures also illustrate the fact that the large wards are not as well staffed as small wards. The patients therefore do not receive the same nursing care. Our aim is to give the patients the best possible attention with the personnel available. We must try therefore to find the most economically sized unit.

Another point to take into consideration when planning the size of the ward is the organisation of the work. Mr. Llewelyn Davies mentioned the experiments in nursing sponsored by the Ministry of Health's Standing Nursing Advisory Committee; these experiments deal in particular

[1] See p. 487.

with the assignment of patients to a trained nurse and a group of student nurses; they also take into account such considerations as different sized groups, number of patients, types of staff available, the teaching of student nurses and staff grouping. The result of these trials will be of interest to the architect, as well as to the nurse.

Most hospitals in the United Kingdom still organise the nurse's work on job allocation; this method is more economical in the use of staff than case assignment or group assignment, but not as pleasant for the patient. The nurses themselves prefer the case or group assignment, for these methods are more interesting, encourage the feeling of responsibility and are also better methods of teaching the nurse her practical work. These methods however are more extravagant in the use of trained nurses—and where are they?

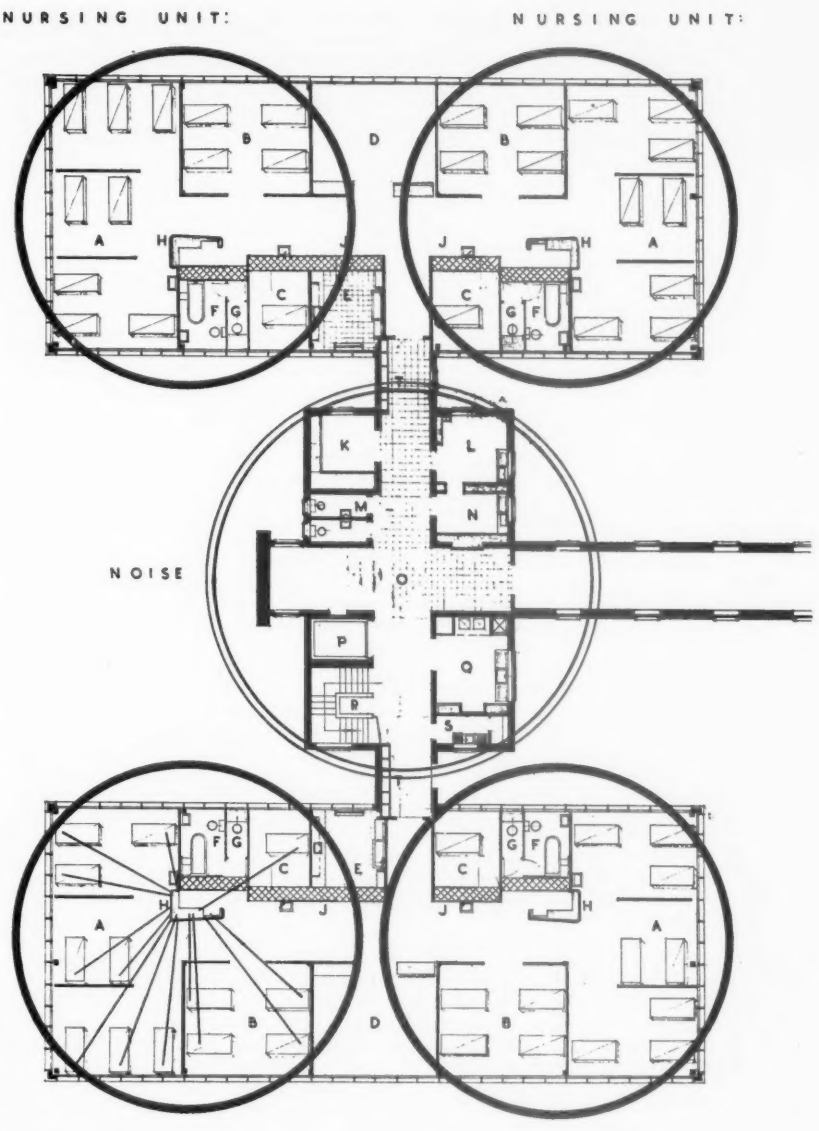
The Nuffield Trust, during the investigation already mentioned, found that none of the hospitals visited had completely adopted case assignment methods for student nurses, but two of the small wards studied were practising it in a modified form. It is significant that these two wards had the highest staff/bed ratios of any of those observed—1 : 1 and 1 : 1·2.

I have perhaps given you more detail than you require but it is important for you to understand the nursing problem from the ward sister's angle. We would like to give the patients the best care, in the most comfortable surroundings, but owing to shortage of personnel a compromise must be found.

Personally, I think the ideal number of acutely ill patients one sister should have in her charge is 20, but this is not an economical number; therefore, under the present circumstances, it is more realistic to plan for a unit of 24 to 30 beds.

The four 20-bed units mentioned by Mr. Llewelyn Davies (Fig. 4) sound as if he intended the unit to be divided into two 40-bed wards, each under the care of one sister. I should not like to criticise this 80-bed unit until I had heard the details of the annexes. The plan sounds compact, but it might be too compact. I do agree that it would be more economical to have seven floors of 40 beds rather than ten floors of 28 beds, but is the designer planning 40-bed wards or 20-bed wards? If the latter, he will waste a lot of space in duplicating his annexes; if the former, he will wear his ward sister out before her time.

The wards of the new Alexandria Hospital in Scotland are designed to form a 52-bed unit, divided into two wards of 26 beds (see plan). The unit is to have one sister in charge and one servicing unit centrally placed, but each unit of 26 beds is to have its own sluice and bathroom. The senior sister will have two staff nurses under her; she will be responsible for the general administration of the ward and a certain amount of the teaching and supervision of the student nurses, while the staff nurses will be mainly responsible for the actual nursing care. This arrangement sounds satisfactory and will be very economical of senior staff, but if all hospitals adopted this pattern it would mean that very few ward sisters could have senior posts, that is, be in charge of their own wards; the junior staff would get discontented, and continual changes would ensue. This particular design, however, should enable the organisation of the nursing to be changed from job allocation to group assignment, as numbers of nursing staff allowed.



New hospital at Alexandria, Dunbartonshire. Ward unit and link unit.

A. 8-bed Ward
B. 4-bed Ward
C. 1-bed Ward
D. Visitors' Sitting-Waiting Room
E. Sluice Room
F. Bathroom
G. W.C.
H. Nurses' Station
J. Cupboard Fitment and Duct
K. Ward Linen
L. Sister and Clinical
M. Staff Lavatories
N. Trolley Dressing
O. Hospital Corridor
P. Bed Lift
Q. Ward Kitchen
R. Staircase
S. H.M.C.
T. Cupboard Fitment

This design is one frequently met in America; a large ward unit is administered by a supervisor, equivalent to our sister-in-charge, and each small ward has a head nurse or ward sister. The supervisor has little real contact with the patients, and the head nurse has no real responsibility as far as the administration is concerned. I wonder whether this system would appeal to the British ward sister? It might work well in a geriatric or long-stay hospital.

There is also another new unit being built in Scotland in connection with the Nuffield Foundation Hospital Trust. This unit will have 64 beds on two floors; 32 beds on each. Each unit will then be divided again into 16-bed units, to be subdivided into three 4-bedded rooms and four single rooms—a central servicing unit for each floor. This design sounds as if it would facilitate the group assignment method of nursing, and also be easier for the ward sister to handle, as she would have a total of 32 patients.

The detailed design of a ward does not come within the scope of this Conference, but before leaving the subject I should like to mention the bed arrangement. This varies with the type of patient. It is usually found that the acutely ill prefer to be alone, or at least not lying in a line with 15 other patients; therefore the ward designs just discussed should be ideal for acute work. Some hospitals have put up perspex partitions in their large wards and arranged the beds in fours, so that the beds are parallel with the walls. In acutely ill children's wards also it is easier to nurse the children in cubicles, but in orthopaedic wards for either adults or children it is better to have the main wall unbroken by partitions, so that the patients can enjoy the various entertainments and parties, or, if children, the school-mistress can do her teaching without moving the beds.

'Wards built a hundred years ago are still in use today, with minor alterations—though inconvenient they are still usable and patients are still being nursed in them. In this the ward may be contrasted with other parts of the hospital where buildings of similar age have often been found wholly inadequate for present-day purposes and have had to be drastically remodelled.' I quote this from Mr. Llewelyn Davies. I know what he means but I do not agree when he goes on to remark that 'the requirements of ward planning change with somewhat less rapidity than do those of many parts of the hospital'. I think the change has been necessary, but the nursing staff have been slow to complain of inconvenience. I was brought up in a Nightingale-type ward and had to walk 192 ft. (96 ft. each way) every time someone at the end of the ward wanted a glass of water—and the nursing needs of a patient are unchanging! It has not been possible to alter old buildings but new designs are much more labour saving. It is important, with an ever increasing shortage of nursing staff, to locate the annexes and offices in a central position, but care should be taken to reduce noise. The annexe could have a lobby (very useful for storing wheel chairs and trolleys), or some arrangement so that patients do not hear what is happening in the sluice room. It is almost impossible to move stainless steel and enamel ware without a sound. Have you ever lain in bed in hospital and heard the click-click of enamel in the early hours of the morning?

When planning a hospital it is usual to use the same design for the ward unit throughout the building; it is probably easier for the architect, but it is also much easier for the nurse—familiarity makes for speed.

At present, early ambulation is the order of the day, but perhaps in a hundred years many patients may be kept in bed longer. The idea of providing wards which would be suitable for all types of patients is a good one, and if the internal walls were not load-bearing, rearrangement of the ward plan need not wait a hundred years.

Before leaving the subject of ward planning, I should like to mention centralisation of certain services connected with the ward. Central supply rooms have developed out of a pressing need to economise in time, effort, materials and personnel. When designing a new hospital it is as well to consider this new trend because the extra space required is not small and the position of the store may be important in regard to the wards. For example, the centralisation of linen. Many hospitals find this a most helpful arrangement—it saves the ward sister many hours of work and much responsibility. If a hospital intends to adopt this method, the ward linen room may become merely a cupboard, but the laundry and sewing room will need extra space for sorting and storing. American hospitals are very fond of various kinds of central supply rooms and in some hospitals all supplies required for the wards at any time, regardless of the frequency with which they are used, are included. I do not think in Britain we should consider this extreme of centralisation but rather should we aim to maintain in the wards those articles in constant use and use central supply rooms for equipment required quickly but not necessarily frequently. One exception to this is a central supply of sterile syringes. This service does not affect the ward design, but could quite easily be irritating to an architect if suggested after his hospital was built. Two fair-sized rooms with special sterilising and cleansing apparatus are required, and these rooms might not be added easily to a completed building.

The Kitchen and the Laundry. Mr. Molander has given some very interesting details with reference to the hospital kitchen, particularly with regard to the temperature of the food. Hot food is usually appetising food, and he has pointed out that it is the ward staff who are largely responsible for seeing that the patients' food is hot and that it is not the distance from the kitchen which affects the temperature; he also stresses the mistake of locating the kitchen on the top floor of a building. I know from experience that this is awkward because it is often quite impossible to enlarge the premises; extra wards may be built, extra staff employed, but the kitchen struggles to maintain a good standard in cramped surroundings.

In many of the old hospitals the respective staff dining rooms are located in the nurses' home or doctors' residence. This means that an already busy home sister has to supervise the meals in the former, and probably one of the administrative sisters in the latter. It is better to have the kitchens, dining rooms and canteens in one block; this helps the staffing and supervising problem and leaves the responsibility of serving the food in the hands of the person responsible for the cooking.

I have already mentioned a central linen store in connection with the plan of the ward. Mr. Molander also advocates a central laundry, and his arguments in favour are excellent. Small hospitals cannot afford modern machinery and do not carry a large laundry staff; if therefore there is a breakdown and an essential piece of equipment is out of action, or a number of laundry maids are off duty, the whole hospital suffers. A centralised laundry worked in connection with a centralised linen room should produce a very useful and satisfactory service for the hospital.

The Out-Patient Department. Demand for out-patients' care has increased considerably in the last six years and many alterations have taken place in out-patient departments. I have met medical men who insisted on seeing their old patients in the wards. This is a very bad habit. The ward is staffed for the benefit of the in-patient, and usually the number of nurses is barely sufficient for this work; if therefore they have out-patients' clinics to attend to as well the ward work might be neglected. It may be pleasant for the doctor to be able to pass from in-patients to out-patients without having to walk the length of the hospital, but it is not a good arrangement. In the Westminster Hospital small out-patient departments are attached to each ward floor; the patients enjoy coming to their old ward for a 'follow-up', but the arrangement is costly in both nursing and lay staff. I think an out-patient department should be placed away from the ward blocks. (I have already given my reasons for wishing the wards to be grouped together.)

The investigations carried out in Sweden give a clear picture of the amount of time taken in moving patients to and from the various departments and prove how important it is to co-ordinate the positions of these departments within the hospital. The department most frequently used by both in-patients and out-patients is the X-ray department, but the out-patient department should also be near to the dispensary and the pathological laboratory. Again, the X-ray apparatus should be adjacent to the casualty department, therefore it would probably save time and porterage to have the former placed at ground-floor level; this arrangement would also save the in-patients a second lift journey.

At this point I should like to mention the entrance hall of a hospital. This varies from the 'hotel entrance type' to the old-fashioned dark hall of a poor law institution. It is important to have a normal and pleasant entrance, as this would undoubtedly have a beneficial effect on the patient arriving at hospital.

If possible, there should be one entrance for in-patients and their visitors—this

would be the 'hotel entrance' type—and another for out-patients. It is better to keep the out-patients' entrance quite separate from the in-patients; the reception is different—porters for luggage, etc. The out-patients also need a pleasant waiting room, which can be part of their entrance hall. Lastly, the casualty department, situated near the out-patient department, should have an entrance to itself. The 'hotel entrance' would not be at all suitable for a casualty patient—something more business-like and utilitarian is necessary to inspire confidence. Personally, I do not think it a waste of money to have three separate entrances to a hospital.

The Theatre. When I visited the Southern Hospital in Stockholm I was shown a beautiful ear, nose and throat theatre. It was used once or twice a week only. Few hospitals in Britain could afford to equip such a lovely theatre for such infrequent use. Though it is nice for a patient to have only a short journey to the theatre, I think it is more important to have the theatres grouped, and not attached to the specific wards; also, to quote, 'the control of asepsis is likely to be more effective in a centralised operating department, where one highly experienced theatre sister is in charge'.

The provision of recovery rooms within the theatre unit is a matter for debate. The main disadvantage is that the patient is nursed by strangers at a time when he is most distressed and nervous, also the nurse does not know the patient, and when a man is very sick it is easier to nurse him if you know what he is like when he is comparatively well—his likes and dislikes, his habits. On the other hand, it is very comforting to the nurse to know that the anaesthetist is on the spot and all the resuscitation equipment to hand.

I should, however, like all theatre units to have recovery rooms where a patient could be kept for the immediate post-operative after-care. This would solve the problem of having to move an unconscious patient from one end of the hospital to another, and though it might not be possible for him to be looked after by one of his ward nurses I think the advantage, especially in this era of complicated anaesthesia, would outweigh any personal distress the patient might feel at the sight of a strange face.

With regard to the grouping of theatres, if the hospital is a large one the vertical arrangement, with a private lift and stairway between the units, would probably reduce the distance between the wards and theatres. On the other hand, the horizontal arrangement is much easier for nursing administration and more economical of staff. I understand that in America some hospitals are actually changing their theatre blocks from the vertical arrangement to the horizontal, as the latter are considered better in every way; for example, economy of rooms and better supervision by the theatre sister.

The internal arrangements of a theatre unit matter as much to the nursing staff as to the medical staff. Many surgeons do not realise this, so I make a special plea here that the theatre sister herself should be asked for advice when a new theatre block is to be built.

The out-patient department and the casualty department should have their own theatres in their own units and naturally these theatres would require well-equipped recovery rooms.

Conclusion. I was asked to give a paper on 'The Hospital from the Nursing Point of View'. I hope my remarks will have given you a picture that will be helpful. The opinions expressed in this paper are personal and open to criticism from all quarters, but I have tried to think of the patients' angle as well as the nurses.

It is very true to say that co-operative thinking by the architect, the doctor, the administrator and the nurse can solve the problem of hospital design and planning. The co-operation must begin in the early stages of the project and continue until the last door handle has been fixed.

In the past, the co-operation has taken place spasmodically, the parties involved have then got irritated with one another over mistakes which would never have occurred if the co-operation had been continuous from the beginning. I must record here that I have been spoilt by your profession. I have met understanding and forbearance, and have often felt grateful for the kind and courteous attention paid to my requests.

The Royal Institute of British Architects has paid a great compliment to my profession by asking me to speak at this Conference. As nurses, we are anxious to help plan the new hospitals of the future and we are honoured that you should have included us in your deliberations.

The General Design Problems of the Hospital from the Medical Point of View

By J. O. F. Davies, M.D., B.S., M.R.C.S., Senior Administrative Medical Officer, Oxford Regional Hospital Board. Read at the R.I.B.A. Hospitals Conference 22 October 1954. Mr. Maxwell C. Tebbitt [*A*] in the Chair.

Introduction. I should like to begin where Mr. Llewelyn Davies has left off, with the stage which precedes design, which he so rightly stresses as being of the greatest importance.

To come to the right conclusions is in every case an essay in human relations, since many people, and often many committees, may be involved. While the R.H.B.s control policy and, strictly speaking, would be within their rights to plan and build a hospital and then hand it over to the H.M.C. to manage, nothing would in my opinion be more stupid in practice. Apart from the relationship between the Board and the H.M.C., any really big project, particularly the building of a new hospital, would need to be specially financed by the Ministry of Health, since no Board could contemplate expenditure of millions from the capital budgets available to them at the moment. The Ministry retain a close interest in these special projects and it is wise to consult with the hospital planning officers at every stage. This not only keeps the Ministry in the picture but in my experience a great deal of help is obtained from the discussions with the Ministry's officers, who are as anxious as any to see new hospital buildings and have a long experience on which to draw. Discussions as plans proceed save the irritation and expense of having to modify final sketch plans.

So far as the clinicians and the Management Committee are concerned, there is no set method for consulting. It is very easy to consult inadequately and leave those who are going to use the building with the feeling that they know nothing about what is going on. Probably the best way is for the clinicians and the Management Committee to elect one or two of their number to meet with the architects and a small number of Board members and officers, and each group report back and consult regularly with individuals concerned. This does not always satisfy, however, and it may be necessary for the architect and the Board's officers to meet all the doctors concerned or all the Management Committee.

The drafting of the programme does make great demands in time on the officers

concerned and it must be agreed that if one senior man can be seconded to the work things go more smoothly. The idea of handing over a complete set of instructions to the architect, from which he is to design a hospital, is not the way to get the best results. The architect should take part in the discussions right from the first if he is to contribute effectively. How far he will need to see the medical staff, the nursing staff and the administrative staff will depend on the method of consultation adopted. If they are adequately represented on the small body doing the planning, the architect may be spared unending consultation.

Hospital planning involves reconciliation of apparent irreconcilables. There is no doubt that such capital as comes the way of the hospital service must be made to go as far as possible. The level of capital expenditure at the moment is £430,000,000 on housing, £57,000,000 on schools and £10,000,000 only on the hospital service. There is no doubt too that every clinician wants the best possible department he can get. Few doctors have more than one building programme which affects them carried out in their professional lives. Naturally enough, each is anxious that his department shall lack nothing, be completely up to date and be tailor made. There is no great appeal in the construction of departments so designed that they will serve several specialities, but that is the kind of economy with which we must all be concerned so long as our capital resources are very limited.

We owe much to the Nuffield Investigation team, who in their researches have examined and measured as accurately as possible the actual needs of certain departments. They have then planned, and in some instances built, on the basis of these findings. We are all most anxious to see the practical results of this enlightened form of planning. Traditional methods of organisation in hospitals die hard and the introduction of the new ideas which come from their researches will probably be brought about slowly until there is opportunity of demonstrating in practical construction the ideas which they have developed.

Planning to Meet Demand. On the size of a hospital to be built, I do not believe that there are figures which could be said to be suitable for a given population. Hospitals in different parts of the country deal with their problems in different ways and at different paces. The very small amount of capital which the hospital service has received over the past few years has stimulated hospitals to new techniques to meet the great demand which the introduction of a free hospital service brought about. I am very much in favour of conducting the kind of survey which the Nuffield Investigation team has been carrying out in the East Anglian Region. Any quantitative assessment is worthwhile. It may not provide all the answers but used judiciously it will go a long way towards doing so, and in any case it is far better than guesswork, however intelligent. As an example of newer techniques I would quote the reduction of average length of stay of surgical patients in the Oxford Region. Since 1950 reductions of average duration of stay in some general surgical wards are as follows: 11·4 days to 8·4 days, 12·2 days to 9·2 days, 13·8 days to 11 days. In general medical wards reductions have been from 21 days to 15·8 days, and from 16 days to 11·2 days, and in gynaecological wards from 9·4 days to 7·3 days and 12·5 days to 8·3 days. These are examples of changes that have been brought about in a relatively short period of time. Similar reductions have been obtained in other branches of acute medicine.

Waiting lists, which are traditionally a reason for increasing the number of beds for treatment, offer much scope for further investigation. The reasons for putting patients' names on waiting lists are many, most of them obvious. In some cases the mere placing of the name on the list has a therapeutic value. We are trying to work out some formula in the Oxford Region which will give us a more meaningful figure than the mere enumeration of the waiting list. The number of beds needed to work down the waiting list to a manageable size is often surprisingly small and can be calculated if certain factors about length of stay and occupancy are known.

In the hospitals for the chronic sick, with which we shall be more and more concerned as time goes by, newer techniques will again serve to replace demands for ever-increasing numbers of beds. The development of geriatrics as a speciality, with clinicians devoting the whole of their time to the care of the aged, is resulting in active investigation and treatment, with consequent discharges and increased turnover of beds, whereas patients in chronic sick institutions were kept in bed until death, often years later. This increased availability of beds, however, may well be paralleled by the increasing age of the population.

Not all the beds for the care of the aged need to be provided and served on the same scale as the general hospital. The acute geriatric or investigating side needs full facilities, but the long-stay annexes can do with more simple provision. The ancillary services for physiotherapy and occupational therapy, however, may need development, particularly if the experimental schemes of providing day hospitals prove to be successful. In the day hospital, patients receive treatment all day with meals provided, and go home for the rest of the day and the week-ends.

Some of the changes in hospital practice come about quickly and much may be achieved in the time which necessarily elapses between the sketch plan and the completed structure. It may be necessary to measure need by means other than the immediate statistics available concerning the hospital. Where the hospital services are poor and new building an urgent need it may well be that general practitioners limit the use they can make of the hospital and refer only urgent cases for opinion. When the service is expanded the demand for diagnosis and treatment is invariably much greater. This demand is not necessarily shown by the existing hospital figures and an approach to general practitioners might be of help, as might enquiry of hospitals outside the area concerned, in revealing what the true load is likely to be.

I think it likely as time goes on and general practitioners become even more skilled in the use of the new powerful medical drugs that are now available that the need for admission to hospital will diminish. If, combined with these weapons of attack upon disease, the practitioner has adequate opportunity for making correct diagnoses, that is to say if laboratory and X-ray facilities are freely made available to him, then we may see more and more patients treated at home and patients admitted to hospital only when they need the special facilities which hospitals alone can provide. If the local health authorities are able to provide home nursing facilities, this too will lessen the demand for hospital treatment. At the United Cambridge Hospitals over the past few years it has been possible to discharge patients from hospital some four or five days earlier than ordinarily by co-operation with practitioners and the local health authority.

These are all trends which will have their influence on the size of the hospital necessary to serve the community. These trends exist in some areas now to a greater or lesser degree, and will need to be taken into account in assessing the size of the hospital. Nevertheless, where we can measure need we should certainly do so, and nothing I am saying now should be construed otherwise.

Requirements of Individual Departments Within the Hospital. *Wards and Ward Blocks.* On the shape of ward blocks I have really very little to say. Patients when they come to hospital, particularly for the first time, are apprehensive and may even be thoroughly frightened. The first sight of the hospital, wherever it be, should not increase that alarm. How far it is possible to give a comfortable kindly feeling to hospitals with wards stacked vertically I do not know. There are certainly many examples of delightful hospitals on single and two floors. But so often the choice between one and the other is determined by the site, the amount of land available and the size of the hospital; nevertheless, the less formidable and more friendly the building the better.

Single storey construction can be carried too far. Some of the hospitals erected in this country during or just before the war cover enormous surfaces and give long walks to special departments. At one such hospital I know, distances between one department and another involve the traversing of half a mile of corridor, and the sending of patients from ward to the X-ray department or to the pathology laboratory in a wheel-chair is such a labour in some cases that a porter must accompany the nurse to push the chair. The time taken over the whole operation is considerable. The surgical

wards in this instance must be located near to the theatres, since long journeys of this kind would be most distressing to patients. The distribution of supplies—pharmaceutical provisions, linen, dustbin services, hardware and crockery—are similarly jobs involving a large number of man hours, since the stores for these service units are generally near to the place which they primarily serve and consequently distant from the wards, which are served secondarily. The porters spend far more time walking the corridors than they actually do in handing over items in wards and departments.

So far as aspect is concerned, the shortness of stay of most patients in acute hospitals makes this less significant than would be the case in long-stay hospitals. Indeed, the difficulty of staffing with young women most hospitals in this country suggests that the places in which the staff work should at least share any benefit that aspect might give. From the purely medical viewpoint there are very few conditions for which sunshine is specifically needed.

The ward will to a large extent determine the shape of the building. There are a number of experiments in nursing going on at the present time and we are hoping to launch two in the Oxford Region this autumn designed to try out some of the recommendations of the job analysis of nursing sponsored by the Nuffield Provincial Hospitals Trust. In my discussions with nursing sisters they have been quite clear that 30 beds is the maximum number for which they can care, and with our present system of responsibilities they may be right. If it can be shown by the experiment that this number can be raised without detriment to patients and without over-burdening the ward sister, then the shape of hospital buildings will change markedly. The important idea, as I see it, to try to develop in future ward construction is flexibility, and by that I do not mean movable partitions. Movable partitions give me the impression of being a universal insurance against inadequate thinking at the time of planning. It is impossible in this way to plan for something which cannot be foreseen. If the circumstances can be foreseen then plan for them. Otherwise I would advocate small wards, each with its own toilet facilities, a number of these small wards forming the unit of the speciality. This would allow not only of varying the number of beds which could be devoted to the sexes, but also allow of other variations, seasonal or more permanent.

Since 1947 when we experienced our first real outbreak of infantile paralysis, we have become more conscious of this disease. The hospitals in which cases were traditionally treated—infectious disease hospitals—have for the most part been put to other uses, and in any case are not generally equipped with the medical personnel now necessary to combat the emergencies which the more serious forms of this disease present. These cases have been successfully dealt with in general hospitals where there are numbers of resident staff and where specialists in anaesthesia, E.N.T. work and other branches of medicine are readily available. The kind of small ward envisaged can readily without danger be put aside as necessary for this seasonal problem, and if we learn to prevent infantile paralysis it is still a ward that can readily be used for other purposes.

Equally there could be a redistribution of some of these small wards to meet other critical situations, including waiting lists which may have got out of hand. So too could there be redistribution between the sexes, since the waiting lists for male and female are not invariably the same. It would even be possible to effect redistribution, though less easily, between specialities in medicine, since the demands are not all the same and to some extent are subject to change.

It is doubtful whether these small wards would commend themselves to the nursing profession. The more the ward is divided up the more difficult it is to keep some of the more seriously ill patients under observation with the present system of nursing. Redistribution of responsibilities in the ward, however, would better allow of this break-up of the ward unit into a series of small self-contained groups. In one hospital in my Region there is one ward unallocated to any speciality. It is a ward in temporary construction and has many deficiencies. Nevertheless, it is a most valuable ward in that it can be put at the disposal of any speciality as critical situations arise. This kind of relief would in my opinion be practicable with the kind of small ward construction now being suggested.

Children's Wards. The requirements of children's wards are somewhat different from those of the general wards. The nursing of very young children, who must be fed and changed at frequent intervals of the night and day, is, if the child in addition is seriously ill, the whole-time work of one nurse, and this on a shift system with off-duty periods may mean three nurses. The late Sir James Spence for years solved this particular problem by admitting mothers to hospital to nurse their own children, and he regarded this arrangement as an indispensable part of nursing in a children's unit. The mother lives in the same room with the child, feeding it, tending it and keeping it in the most comfortable posture, with the sister and nurse at hand to help and administer technical treatment. It is now generally agreed among paediatricians that in any children's unit there should be a sufficient number of cubicles large enough to take an adult bed with the cot for the infant. This is one of the particular and special problems of the children's unit.

A day room should probably be provided for mothers, with bathroom, lavatory accommodation and telephone arrangements special to the mothers, so that they can keep in touch with their husbands and homes.

Paediatric wards now tend to take medical and surgical cases without discrimination between them. Many paediatricians are against placing too many babies in one place and they prefer the age groups to be mixed, as in the normal family. There is probably a good deal to be said for this, because toddlers looking at each other are intensely bored whilst little girls of nine and ten and older are generally very pleased to look after smaller ones, and it may be that a combination of these age groups is a good arrangement.

The children's ward requires to be provided with two four-bedded admission wards (or perhaps four two-bedded ones) with beds widely spaced, to which new undiagnosed cases can be admitted. Once the children have been screened they are better moved to a larger main ward with more company. Over and above this there should probably be single rooms required for 5 to 10 per cent of the total number of patients. This total number in the opinion of many should not exceed 24 or 25 in one ward.

There is probably little future for the isolation hospital and there should be an isolation block as part of the children's department. Special provision in the children's unit is the milk kitchen. Feeds are now prepared for the most part on prescription in the milk kitchen, just as medicines are prepared in the dispensary. They are then sterilised and taken to each ward sealed, so that the bottles are not opened until they have reached the babies.

In each children's unit there should be a treatment room in which dressings, lumbar punctures and painful manipulations are carried out and where anaesthesia will be needed frequently for the removal of painful dressings.

There is a good deal to be said for and against the children's hospital as opposed to the children's department of a general hospital. My own preference is for the latter. In any case it is probably desirable to place the children's department separately from the main hospital.

Maternity Units. Maternity units again have special requirements. The essentials are a number of small wards of not more than four to six beds, perhaps not more than two. There should also be some single beds for patients who require isolation for any reason. The incidence of sepsis in maternity units is now very low and most infections respond to treatment, but even so most obstetricians want to be able to isolate any of their patients readily. Among the special rooms required are those in which patients pass the first stages of labour. They should be near to the labour rooms in which delivery of the infants takes place. Maternity units are best provided with a theatre for the occasional operative interference necessary. The department also requires a milk room in which milk feeds are prepared to supplement mothers' milk where needed.

The practice in most institutions in the past has been to provide nurseries for most of the babies to be housed at night. Indeed, many hospitals keep the babies wholly in the nurseries, taking them to their mothers

only at feeding times. There is here a conflict of interests between the child specialist and the maternity specialist. The latter wishes the mother to make a good and quiet recovery, to have all the sleep she can and fit herself for the job of going home to cope adequately there with the new arrival. The paediatrician wants the mother and baby kept together, allowing the mother to pick the child up and feed it as needed, which amounts almost to when it cries and not at fixed hours. There is a movement away from the rigidity of three or four hourly feeding to what is termed 'feeding on demand'. Paediatricians hold that infection of the newborn child is less if given as much to the mother as possible and that there are many other advantages.

If this be accepted, then the smaller the wards the better, and the less need there will be for nurseries. My own feeling against nurseries of any size is strong. The infants are very young and tender plants and any misfortune may affect all in the nursery. Disasters do occur in the best conducted hospitals and I am firmly of the view that babies should be kept with their mothers. I have seen some of the plans of the new hospitals in Spain. Some of the maternity departments have only two- or three-bed wards as I have suggested. One surgical department I noted had two-bed wards almost exclusively and would have made a very good maternity unit.

With the maternity department should be the ante-natal clinic, and both can well be separate from the main hospital but near to the children's department.

Out-patient Departments. The cost of in-patient hospital provision in most sizeable hospitals is so high that the likelihood is that out-patient treatment will develop more and more. The demands for out-patient treatment as shown by the figures in the Oxford R.H.B. area have now begun to level off. They exceed the figures before the National Health Service Act, however, by as much as 50 per cent. While a good case might well be made that we have enough beds on the general hospital side—if they were properly distributed and all of good standard—there is no doubt that over the country as a whole much still remains to be done to expand and improve the working conditions in the out-patient departments. Out-patient departments throw greatly increased loads on the X-ray and pathology services. In the past, in many cases when the out-patient department has been rebuilt or enlarged, insufficient attention has been paid to these special departments, which have then become bottle-necks. Included with any sizeable out-patient department should be additional radiological and pathological facilities. Where practicable, these should be part of the main departments of the hospital, which are best placed between the wards and the out-patient department. Where new out-patient departments are being erected, however, unless it be possible to expand the existing special services to meet the new out-patient demand, new special X-ray and laboratory facilities should go with the out-patient building.

As to whether the out-patient departments should be separate from the main hospital or on the same floor as the wards which they serve, the answer in my opinion is in the separate building for the most part.

There are some specialities—eyes, ear, nose and throat and dermatology—where the proportion of out-patient attendances related to the number of beds is much greater than in the main specialities. Out-patient clinics are large but the departments have few beds. There may be advantages in combining in these instances the out-patients with the ward. I am aware that the arguments in favour of having out-patient departments near the wards are that both patients and nursing staff gain in confidence by knowing each other before, during and after in-patient treatment and that there is an economy in special equipment. Nevertheless, with the possible exceptions in the specialities that I have mentioned, my belief is that out-patient departments should be separate.

There are advantages in having the casualty department with the out-patients. Casualty surgery is some of the most responsible work which junior surgeons are called upon to undertake, and it is generally desirable to have close to the casualty department senior medical staff working in out-patients. A high percentage of casualties are in fact not surgical cases but medical, and good casualty departments should have a number of rooms equipped to deal with these medical problems. We are hoping to achieve this in a new out-patient department we have planned. The casualty department will have two theatres, one clean and one dirty. Nearby are two out-patient theatres. The hospital concerned has with very inadequate facilities been developing its out-patient surgery until now eight half-days per week are given over to it. With the new theatres we have designed changing accommodation for the patients and recovery rooms from which they will be discharged, generally at the end of a few hours.

There is much to be said for a uniform pattern of consulting-room suite. Tailor-made suites which can be used for no other purposes are probably in this day and age an extravagance which we can ill afford. It is not as a rule difficult to provide some special facility for special departments. Even where the department is wholly used by one speciality there are still virtues in as great an architectural uniformity as is practicable, because not all clinicians have the same ideas about the placing of the apparatus which they use and changes in doctors do occur.

Operating Theatres. The development of surgery into highly skilled specialities—cranial surgery, thoracic surgery, genito-urinary surgery, plastic surgery and many others—has tended to increase the number of theatres needed, since the work of some of the specialities involves very long operating sessions. My discussions with anaesthetists lead me to believe that in the future requests will be made for recovery beds immediately available, that is to say, within the curtilage of the theatre. The most dangerous time of anaesthesia is not in the operating theatre, where anaesthetists, surgeons and other staff are available, but in the first hour or two after the operation when the still unconscious patient, without a number of reflexes, is recovering. If there are two surgeons operating at the same time in twin theatres on both male and female patients, from this one pair of theatres patients are being spread to four wards, which are often at a considerable distance from the theatre. If an emergency occurs during the recovery period it takes time to call specialist help to the patient's aid. If the recovery ward is within the precincts of the theatre help is available at once, and the anaesthetist or his assistants can regularly visit all the patients between operations until they are satisfied with the patients' condition. In some of the modern techniques, patients' blood pressure is reduced to low levels, from which it is brought back to normal in the succeeding twelve hours. During this stage, particularly in the early part of it, careful observation close to the theatre is what is needed. If all these patients are grouped together in a recovery ward in charge of a skilled sister or nurse, with expert help quickly available, the risk is greatly minimised.

In such a ward it would be desirable to have oxygen and suction piped to every bed. One ward might do for all these patients, with some division to separate the sexes. Nor need the bed spacing be anything greater than that which nurses would require to attend to the needs of the patients. The need for the recovery ward is not confined only to the patient who is gravely ill. Close observation is often needed after relatively minor operations.

I am aware that there are some acute nursing problems in connection with recovery wards and that a clear definition of responsibility is necessary. This, however, should not prevent the introduction of recovery wards. If the need for a recovery ward be accepted, then whether the theatres are grouped vertically close to the wards which they serve, or horizontally and distant from the wards, is a matter of much less significance. The main advantages of theatres stacked above one another were that patients had short distances to travel back to the wards and that pipe runs of various kinds could be kept straight. Each theatre, or each pair, was a completely separate entity from every other theatre or pair of theatres. One of the advantages of having theatres on one floor is that surgeons, anaesthetists and others are able to meet each other easily and regularly and senior clinicians and nursing sisters can supervise what is going on in a number of theatres with much greater ease than they can if theatres are stacked vertically. I think on the whole the advantage lies with the grouping of theatres on a horizontal plane and I should like to make them all identical in size and type capable of being used for special purposes by means of special equipment. The theatres

in the casualty department, to which I have already referred, can I think be less elaborate than those doing the main surgery of the hospital.

Some very useful experimental work is going on under the aegis of the Birmingham Regional Hospital Board and promises to provide some architecturally exciting results. It is not for me to speak of the work they are doing, but I would like to say how much there is the need for study and observations on what goes on in the theatres and application of the knowledge gained to the design.

Conclusion. I should like to be able to say something useful about the future of the various specialities in medicine which might help you in planning. I am doubtful about my ability to do so, however. The future, whatever the medical changes or advances, will be influenced by the ability of hospital medicine to recruit nurses into its service. It is very doubtful whether we can look forward to any great change, and the situation may worsen. One of the effects of this might be that we should have to think of wards as small highly-equipped units in which full-scale nursing by skilled personnel was carried out, each ward with a dormitory attached with cafeteria facilities. Patients would be moved from beds for acute illness to a kind of community life as soon as possible and be looked after by relatively few unskilled personnel under the general control of the ward sister. The type of construction for the convalescent or community part of the ward would be domestic, not hospital, and might be cheaper. It would need many more bathrooms and lavatories than ordinary wards. Early ambulation would be the rule, not the exception. It may well be that in certain branches of medical work, say geriatrics, into which nursing recruitment is most difficult, relatives may be called in along the lines mentioned earlier in paediatric wards. This may well come about when the population contains ten million people over the age of 65, as will be the case in 1971.

The number of specialities, as has been mentioned earlier, grows, with consequent need for special facilities. The practice of ear, nose and throat surgery is becoming more restricted, the thoracic surgeons having expanded their field. Surgery is likely to be more that of degenerative lesions in old people rather than the very young, so great has been the influence of new drugs. Orthopaedic surgery, too, will deal much more with the aged as preventive medicine diminishes the number of cripples. Similarly ophthalmic surgeons will be more concerned with operations on the elderly than on the young, where the preventive work of the school health service is seen.

I have already suggested that general practitioners with home nursing facilities and hospital investigatory resources may limit the number of patients to be admitted. I have suggested that the need for large numbers of additional beds is not nearly as great as was once thought. Many wards require enormous improvements and in some cases to build anew might be cheaper and better. I am satisfied about the directions in which the general hospital service needs to be expanded. We need to make the best use of what we have and for that purpose our out-patient diagnostic and treatment facilities must be expanded. We must expand our laboratory and X-ray services to meet out-patient, hospital and general practitioner needs. We must make operating theatres available in adequate numbers.

I have today only touched upon the general hospital. I would like to remind architects that the greatest amount of work still remains to be done in the mental hospitals. These institutions for the most part were erected in the middle of the last century and, taken by and large, little has been done for them. The demand for mental hospital accommodation has increased almost beyond imagination, and the number of patients voluntarily seeking treatment as a percentage of the whole has risen and continues to rise. Buildings in which we have to put these patients are unsuitable. The 'mental health million', which is allowing of the erection of admission units in my Region and doubtless other much needed buildings in other Regions, is going part of the way to meet a very great need. I hope that at some future meeting you will take it upon yourselves to devote at least one session to the needs of the mental hospital, in which there is a very fruitful field for architectural design.

The London Builders' Conference

Report of the Monopolies and Restrictive Practices Commission

THE REPORT of the Monopolies and Restrictive Practices Commission on the 'Supply of Buildings in the Greater London Area' was published on 27 September.

The full report which is published by the Stationery Office (price 3*s.* 6*d.*) is a lengthy document consisting of 115 pages and the following is the summary issued to the press:—

The Supply of Buildings in the Greater London Area. The Commission were asked to see if the 'conditions' to which the Monopolies and Restrictive Practices (Inquiry and Control) Act 1948 applies prevailed as respects the supply in the Greater London area of new buildings costing more than £1,000 each to construct. They have found that the conditions do prevail, since more than one-third of such buildings are supplied by persons who conduct their affairs in such a way as to restrict competition. In January 1953 members of the London Builders' Conference (L.B.C.) together with 'co-operating non-members' (non-members who co-operated with the Conference in particular competitions) were responsible for about 65 per cent of the work done in that month in terms of value and labour. The Commission consider that competition is restricted by the arrangements operated by the L.B.C.

The Commission were also asked to report whether two particular practices were 'things done' as a result of or for the purpose of preserving those conditions and if so whether they were against the public interest. The two practices were the communication of the amount of proposed tenders to third parties by agreement or arrangement, and the adjustment of the amount of proposed tenders by agreement or arrangement with third parties. The Commission find that these two practices form an integral part of the L.B.C.'s arrangements and are 'things done' as a result of and for the purpose of preserving the conditions to which the Monopolies Act applies.

Commission's Conclusions on the Public Interest. *The L.B.C.'s Arrangements.* Since any communication or adjustment of proposed tenders by arrangement between builders means that 'the tenders cease to be the independent offers they are held out to be' the Commission consider there is reason to suppose that both of these practices are *prima facie* against the public interest.

The Commission pass on to consider whether these practices are beneficial or harmful in the particular circumstances in which they are operated. The following considerations are amongst those taken into account:—

(1) The fact that the Committee on the Placing and Management of Building Contracts (the Simon Committee) recommended in 1944 that tenderers should be limited in number and carefully selected does not, in the Commission's view, justify builders on their own trying to deal with the situation by means of a scheme, such as that operated by the L.B.C., designed to limit the choice of building owners.

(2) The Commission have found no support for the Conference's claim that its arrangements have resulted in a tendency towards smaller competitions or the inclusion only of builders of equal standing.

(3) The Commission are not satisfied that the application by the L.B.C. of its Fair Price Scheme (involving the communication and adjustment of the amount of proposed tenders) results in prices which are as fair to all parties as the prices that would result from independent tendering.

(4) The Commission believe that the L.B.C.'s arrangements, in view particularly

of the secrecy which largely obscures the effect of their operation on particular contracts, have intensified ill feeling due to lack of confidence between architects and builders, to the detriment of that co-operation which is so necessary to the efficient working of the industry.

(5) The Commission do not accept the L.B.C.'s argument that, if the market for building became severely competitive, its arrangements regularly applied could provide builders with the financial strength they would need to resist the cutting of prices and quality. Nevertheless, they think that in such conditions the Conference could, and no doubt would, extend its arrangements, and they consider this would not be desirable.

(6) The Commission consider that while the L.B.C.'s Tendering Scheme (involving the adjustment but not the communication of the amounts of proposed tenders) achieves some redistribution of the incidence of tendering expenses between building owners, it does not effect any improvement over the normal method of allocation of tendering expenses as an overhead expense. And even if, as the Conference says, its arrangements by reducing the size of competition could lead to a reduction in the total expense of tendering which falls on the building industry, in the Commission's view such saving may be too dearly bought at the price of restricting competition in the industry.

The Commission conclude that the effects of the L.B.C.'s arrangements as a whole on the public interest are harmful and therefore afford no justification for the two practices which form an integral part of those arrangements, and that both of the practices are against the public interest.

Cover Prices. The Commission regard the practice of submitting cover prices (tenders meant to be sufficiently high not to win the contract) as coming within their terms of reference in relation to the public interest only when there is a mutual understanding between two or more builders affecting the amount that at least one of them is to quote. In so far as the practice forms part of the Fair Price Scheme, the Commission have taken account of it in their general conclusions on the L.B.C.'s arrangements. With regard to its use in second competitions, the Commission think that the proper course for a builder who disapproves is to decline to tender or re-tender, and regard the formation of a 'ring' for the purpose of inducing the building owner to accept a particular builder's tender as undesirable. They conclude that such circumstances afford no justification for the practice of adjusting the amounts of proposed tenders by mutual arrangement.

Commission's Recommendations. The Commission have recommended that agreements or arrangements of the kind specified in the reference should be brought to an end. They have made no recommendation as to the method by which this should be done as in their view it can be determined only after discussion between the appropriate Government Departments and the parties concerned.

The R.I.B.A. submitted both written and oral evidence to the Commission which is summarised in the report and the correspondence which took place between the L.B.C. and the Joint Committee of Architects and Builders in 1939 and that between the L.B.C. and the R.I.B.A. and R.I.C.S. in 1945 is quoted in full in Appendices 3 and 4 of the report.

The Monopolies Commission's findings confirm the views expressed by the R.I.B.A. and R.I.C.S.

As will be seen from the last paragraph of the summary quoted above the Commission have recommended that agreements or arrangements of the kind specified in the reference should be brought to an end, but they have made no recommendation as to the method by which this should be done as in their view it can be determined only after discussion between the appropriate Government Departments and the parties concerned. It is understood that the Minister of Works has the matter under consideration. It is hoped that the L.B.C. will agree to discontinue their activities. It is not proposed therefore to give further advice to members at the moment.

Many of the problems which were responsible for the setting up of the L.B.C., such as the early notification of the results of tenders, were examined by the Joint Committee on Tendering Procedure (The Howard Robertson Committee) and recommendations made which if acted upon will help to solve these problems.

It is appreciated that other difficulties may remain or may arise in the future and it is the duty of the recently formed Joint Consultative Committee of Architects, Quantity Surveyors and Builders to examine such matters which could properly be submitted to the Joint Committee through the National Federation of Building Trades Employers.

Practice Notes

Edited by Charles Woodward [*A*]

MINISTRY OF HOUSING AND LOCAL GOVERNMENT. Footpaths and Bridleways. Circular 65/54, dated 14 September and addressed to local authorities in England, refers to the procedure to be followed when creating, diverting or extinguishing public rights of way under the National Parks and Access to the Countryside Act 1949 and the Acquisition of Land (Authorisation Procedure) Act 1946.

The Circular is an amplification of the information of the Notes previously given in respect of the National Parks Act in paragraphs 2 and 3 of Part 1, and reads as follows:—

Paragraph 2—*Grounds on which Orders can be made.* (*a*) DIVERSION ORDERS. The Minister is advised that by virtue of Section 114 of the Act, the word 'use' in Section 42 bears the same meaning as in Section 119 of the Town and Country Planning Act 1947, i.e. that it does not include the use of land by the carrying out of any building or other operations thereon. Accordingly, Orders should not be made under Section 42 where the purpose is 'for securing the efficient use of the land', where the use in question includes the carrying out of any building or other operations. Such cases may be dealt with under the provisions of Section 49 of the Town and Country Planning Act 1947, which are expressly designed for use where diversion of a path is necessary to enable development to be carried out in accordance with planning permission; or under the provisions of Section 3 of the Acquisition of Land (Authorisation Procedure) Act 1946, which apply to land acquired or proposed to be acquired by a Local Authority, and are referred to in Part II of the above-mentioned Notes.

Paragraph 3—*Consents and Consultations required before making Orders.* Order-making Authorities are reminded that the powers conferred upon them by Sections 39, 40, 42 and 43 of the National Parks and Access to the Countryside Act 1949 are not exercisable unless the consent of certain other Authorities mentioned in Paragraph 3 has first been obtained. If an Order-making Authority make an Order without first obtaining consent under Sections 40(3) or 44(1) (highway and local planning authorities) and Section 101(6) (*a*) (the 'appropriate authority' where Crown land is concerned), as the case may be, there is no way of rectifying the omission. The Minister is advised that any such Order would be invalid and that he would have no power to confirm it. Authorities should therefore ensure before putting their seal to an Order that all consents required have been given in due form. Where the consent of a County Council is required it must be the consent either of the County Council or of a Committee duly authorised by the County Council to act on their behalf. An indication that the formal consent of a County Council or a local planning authority is likely to be given would not satisfy the requirements of the Act, and if formal consent did not follow until after the Order was made, the Order would be invalid.

The Circular is obtainable at H.M. Stationery Office, price 2*d*. It may be of interest to members who wish to know whether the correct procedure has been followed in the making of Orders in respect of public rights of way.

LANDLORD AND TENANT ACT 1954. H.M. Stationery Office have published two booklets explaining in general terms the provisions of this Act which came into operation on 1 October. Each costs 6*d*.

The booklet entitled *Houses held on*

Ground Leases outlines the main provisions of the Act as they affect the tenant or leaseholder occupying a house under a ground lease and also his landlord. The provisions in respect of dilapidations may be of interest to members.

The other booklet is entitled *Security of Tenure of Business Premises* and gives the provisions of the Act as they affect landlords and tenants (including sub-tenants of shops, offices, factories and other business premises). 'Business' as defined in the Act covers the offices of professional men and to that extent may interest members.

The booklets are intended as a guide and do not take the place of legal advice.

NATIONAL JOINT COUNCIL FOR THE BUILDING INDUSTRY. Rates for Watchmen. As from 4 October the new rates for watchmen are: London and Liverpool 21*s.* 0*d.* per shift. Provinces 19*s.* 9*d.* per shift.

Tool allowances for carpenters and joiners. As from 4 October National Working Rule 3 E (*a*) has been amended to read as follows: (*a*) Carpenters and Joiners providing and maintaining all necessary tools as and when required in connection with their works: (i) When employed in establishments operating under the supplementary Rules for Woodworking. Factories and Shops, 2*d.* per day. (ii) When employed on other building industry work, 4*d.* per day.

HOUSE BUILT ON THE WRONG SITE. The ESTATES GAZETTE for 18 September contains a report of a case where the builder, after beginning to build a house, found that it was on the wrong site. The builder said that he bought land which was described as cleared, and as the site was the only cleared one he took it to be his. The difficulty was solved by the builder buying the site from the owner for £1,000.

This is somewhat similar to the case of a demolition contractor who began to demolish an old building and was then told it was the wrong building. His reason was that he was told to pull down an old building in the street, and as this was an old building he commenced work. He had to reinstate the building at his own expense.

TIME CHARTS. It would appear that there are other uses to which time charts may be put than in respect of the progress of a building. An architect, annoyed by excessive piano-playing by his next door neighbour, made red marks on a sheet of squared paper when she was playing and a black mark when she stopped playing.

In an application to the Court for an injunction to restrain the lady from causing annoyance by piano-playing to excess and at unreasonable times, the architect produced the chart, and the Judge granted an injunction limiting the piano-playing and said that one hour in the morning and one hour in the afternoon he would not regard as unreasonable. It appeared that at first it was mostly scales that were played and the addition of 'In a Monastery Garden' and a polka was the last straw.

The use of such time charts might be extended to an adjoining radio as a prelude to application for an injunction.

ROYAL INSTITUTION OF CHARTERED SURVEYORS. The Housing Repairs and Rents Act 1954. The Institution has published a book on this Act which has been written by Robert Steel, B.Sc. (Est. Man.), the Assistant Secretary.

The book presents the relevant legislation, statutory instruments and official circulars likely to be useful to practising chartered surveyors.

The chapter on Improvements Grants should prove of value to those dealing with such applications, and makes it clear that an authority's decision on the application will be final, as the provisions of Section 20 of the Housing Act 1949 are permissive and not mandatory. It is also emphasised that a means test of the applicant is an irrelevant factor. The Minister has told authorities that there is no statutory provision for such a test. An aggrieved applicant does not appear to have any right of appeal, so that negotiation with the authority is necessary, particularly as work started before approval of the proposals is a disqualification and the authority cannot then entertain the application. It is pointed out that every authority using open spaces for temporary housing accommodation under the Housing (Temporary Accommodation) Act 1945 must submit to the Minister by not later than 28 February 1955 proposals for rehousing the occupants elsewhere.

There is a very full index which makes for easy reference to the sections of the Act dealing with a particular matter. The index to statutes is also important. It is understood that there are some copies of the book available to other than members of the Institution, price 7*s.*

ARBITRATION. Remitting an Award. The Arbitration Act 1950 gives power to the Court to remit to the arbitrator for reconsideration any matters referred to in an award and the arbitrator has then three months within which to reconsider the points remitted to him, unless the Order directs a different time.

The reason for remitting an award would appear to depend upon whether a defect in it can be remedied without the Court looking at documents in order to construe some provision in the award or resolve some ambiguity in it. It seems to be clear that such documents cannot be looked at in order to extract something from them and insert it as a term into the award, and if there is no other way of curing a defect in an award it would appear that the only course would be to set the award aside.

If an award is ambiguous and uncertain it may be sent back to remedy such things. There is no obligation on an arbitrator to give a reason for his decision, but if he has, and the reason is defective, it would not appear that there is any rigid rule that, because there is an error of law on the face of an award, it should never go back. If an award contains defective reasoning and the defect may be due, not to an error of law, but to an omission to set out some step in the arbitrator's reasoning, it may be that it would not be improper to send it back to cure that defect. The Court would have in mind that, if it is avoidable, the parties should not be put to the expense of starting *de novo*, but an award would go back only if that could be done with justice to the parties. If an arbitrator has given a reason, it would appear that a party who desires to do so ought to be able to show the Court, on the face of the award, what moved the arbitrator to reach his decision.

Remission or setting aside an award are questions for the discretion of the Court in all the circumstances of the case, and the general principles upon which the Court would act appear in the case of Kiril Mischaff, Ltd. v. Constant, Smith and Company (1950 All E.R. Vol. 1. Part 17).

As there is no obligation on an arbitrator to state the reasons for his decision, it is a little surprising when that is done. If the parties wish the opinion of the Court upon a point of law, that can be obtained by the arbitrator stating a case, but that is a different thing from an arbitrator doing something which he need not do and so perhaps putting the parties to expense which could have been avoided.

An award should be drawn only under legal advice. Otherwise a Court may find, on the face of the award, that an arbitrator has arrived at a right decision for the wrong reasons, or a wrong decision for the right reasons!!

Book Reviews

1946–1953. The New Architecture in Great Britain, &c., by *Edward D. Mills.* 12¼ in. 209 pp. incl. pp. of illus. Text illus. Standard Catalogue Co. 1953. £2.

It is obvious from a first glance through the illustrations of this beautifully-produced book that the British contribution to the global development of a new architecture is hampered not so much by lack of talent as by lack of opportunity.

We all know that the years 1945–53 were unbalanced and restricted through lack of materials and of money, and that what architecture the state made possible came embedded in a mass of regulations and controls, and attended by far too great a number of government officials far too much interested in architecture. The climate was therefore unfavourable; lacking choice, continuity or a sufficient measure of confidence; and thus the story of architectural development, pursued with such zest in the United States and in Latin America, was in Britain halting and timid by comparison.

This is by way of excuse, for it has to be remembered that the period covers a programme of generating stations quite sufficient to have launched a new architecture on its own if authority had had a sense of architectural direction. Lacking it, they have the power but not much of the glory; and the industrialists, in the examples of the Bryn Mawr factory and the Brabazon Hangar, come off with a better record.

Housing operates with us on a higher level of consciousness, and there is more to show and of better quality. The Finsbury flats and the great Pimlico scheme are contributions of originality and vigour, and they stand out against a background of much other work of merit as part of a national policy of regeneration carried out under difficulties, but nevertheless carried out. With school building it forms an activity that is expanding, continuous and optimistic, and therefore encouraging to architectural development.

The Festival of Britain acted in the same way by providing an opportunity for unrestricted experiment in a cheerful atmosphere, and reaped its reward, and found a response from a wide public which will eventually take the new concert hall to its heart, as well it should.

One wishes the record of achievement were longer and braver, but for what it is we must be thankful; and to Mr. Edward Mills all thanks for compiling the record with such care; his comparative method succeeding admirably and his critical comments most acceptable.

Not least valuable, in a book so well produced and edited, is Sir William Holford's introduction which I found enthralling.

This is, we hope, only a first volume.

E. MAXWELL FRY [*F*]

Ackermann's Oxford. A selection of plates from *R. Ackermann's* 'A History of the University of Oxford, etc., 1814,' and *James Ingram's* 'Memorials of Oxford, 1837.' Notes by H. M. Colvin. (The King Penguin Books, 69.) 7 in. 36 pp. + 8 + 16 pls. Penguin Books. 1954. 5s.

Vatican 1. The Basilica of St. Peter. La basilique, etc., by *Paul Letarouilly*. (Part only of 'Le Vatican et la basilique, etc., 1882.') (Text) by *A. E. Richardson*. 11 in. × 8½ in. 14 pp. incl. p. of illus. + 104 pls. Tiranti. 1953. £1 5*s*.

Italian Gardens of the Renaissance, by *J. C. Shepherd* and *G. A. Jellicoe*. 2nd ed. 8½ in. viii + 25 pp. + pls. and pp. of illus. text illus. Tiranti. 1953. £1 5*s*.

In days of economic stringency reprints of old works in handy and not too expensive form are of great value, not only to school students but often to a wider world, and these three works, on widely different subjects, are contributions of this kind.

The King Penguin version of Ackermann's and Ingram's works of over a century ago gives 16 of the hand-coloured aquatints of the former, looking at least as lurid as their originals, and 8 steel engravings of the latter, reduced by photogravure with a curious rich effect. There is no list of plates. There is a useful historical introduction.

Tiranti's Letarouilly, which in fact is an instalment of the original one-volume work *Le Vatican et la Basilique de Saint Pierre de Rome* confined only to the church, will be followed (so says a note) by two other volumes, dealing with the palace, if support is forthcoming; the covering title *Vatican* is ambiguous. A pictorial restoration of the early Christian basilica is followed by the successive plans of the Renaissance masters and measured drawings and details of the existing church. There is an annotated list of plates, but no index. Text and captions are in French and English.

Shepherd and Jellicoe is rather more and less than a reprint: the introduction is revised (the authors having, understandably, 'succumbed to the charms of the Isola Bella on Lake Maggiore'), but descriptive text notes are omitted and the whole is reduced from the folio of 1925 to an octavo. There are over 70 views, either ink sketches, old engravings, or photographs, and about 50 plans and other measured drawings, which should be of great practical use to students. There are a useful chronological table, *c.* 1396–1800 odd (would that more writers would include one!), and an index of places and persons, both at the beginning.

H. V. M. R.

The 'Expanding Environment. The end of cities—the rise of communities, by *E. A. Gutkind*. ob. 7¼ in. × 10 in. 70 pp. + (12) + (4) pls. and pp. of illus. Freedom Press. 1953. 8*s*. 6*d*.

Community and Environment. A discourse on social ecology, by *E. A. Gutkind*. 9½ in. xiii + 81 pp. Watts. 1953. 12*s*. 6*d*.

Dr. Gutkind's style reads like a transcript of a lively and provocative lecture, and it suits his theme. In *The Expanding Environment* he quotes Walt Whitman: 'Let insanity still have charge of sanity', and makes his subversive attack on the same big cities of today. We only live in them from habit, because they are there already, and, Dr. Gutkind maintains, modern communications make it not merely unpleasant but grossly inefficient for industries to congregate in congested cities. Pull them down before they are blasted down: it is time for a new environment of integrated communities of the proper size, harmonising not conflicting with the landscape. Dr. Gutkind describes great cities of the past: some, like ancient Athens, seemed to know when to stop growing, and he hopes his communities would know, too; but looking at his sketch maps (pp. 63 and 65), it is easy to imagine them joined by ribbons of 'development' till the whole countryside would be engulfed by suburbia.

In *Community and Environment* sociologists and planners are under fire. The social fabric ought not to be imposed, but should grow. Man ought not to divide his time between work governed by machines and leisure governed by material comforts, but should live. Unfortunately he does not want to. He prefers ugliness to truth, security to freedom; the quotation from Dostoevsky's Grand Inquisitor is only too apposite.

Dr. Gutkind is good at analysing what is wrong and setting out his forceful ideas on what is to be done, but he does not consider how to do it. He admits that his discourse may seem ' "philosophical" and highly speculative', but it is certainly stimulating.

M. W.

The Architect and the Law, by *Richard Body*. (Institute of Registered Architects.) Reprint. 7¼ in. viii + 71 pp. [Lond.] 1954. 8*s*. 6*d*.

This book consists of 65 pages and is a condensed form of legal information concerning the law as it relates to a practising architect. Since publication the statement on page 1 in connection with the architect's employment for a year or more being in writing is no longer the law. The Law Reform (Enforcement of Contracts) Act 1954 has repealed this requirement and it is not now necessary to produce evidence in writing if a verbal agreement has to be enforced. This provision will not affect a contract between a local authority and an architect, which must be in writing under the seal of the authority.

The chapter on the architect's certificates suggests that the architect may charge a fee for making a valuation for an interim certificate, but it would avoid misunderstanding if the client's prior agreement was obtained. In connection with interim or final certificates the contractor, under the R.I.B.A. Contract, can always appeal to the arbitrator if the architect is withholding any certificate.

There is a useful chapter on a partnership agreement and on the architect's relations with the contractor. Copyright and the ownership of drawings is clearly explained. The chapter on arbitration suggests that an arbitrator may announce his decision at the conclusion of the hearing, either giving his reasons at the same time or arranging to do so later. This would appear to be a very unusual course and could very well result in the decision being set aside by the Court. An arbitrator is not obliged to give reasons for his decision, and an experienced one never does. It is stated that the Court will grant an injunction 'where the arbitrator is acting impartially'. The Court's injunction would no doubt be to order the arbitrator to continue to act impartially.

The book gives the legal principles involved in an architect's practice and if they are borne in mind a professional career may perhaps complete its course without coming into serious contact with the legal profession. As the author says, every professional man is expected to have a working knowledge of the law as it affects his profession.

C. W.

Concrete Farm Structures, by *A. M. Pennington*. (Concrete series.) vi + 153 pp. text illus. Concrete Pubns. 1954. 12*s*.

The reader should remember that this book, like others in the series, is specifically intended to encourage the use of concrete instead of other materials possibly as suitable; but it may be commended for clearly presented information on many types of farm buildings. The designs are based on recommendations of the Ministry of Agriculture, although the author takes exception to B.S. No. 2053 on General Purposes Farm Buildings and gives his own alternative dimensions. He is not alone in his preferences.

Review of Construction and Materials

This section gives technical and general information. The following bodies deal with specialised branches of research and will willingly answer inquiries.

The Director, The Building Research Station, Garston, near Watford, Herts.
Telephone: Garston 2246.

The Officer-in-charge, The Building Research Station Scottish Laboratory, Thorntonhall, near Glasgow.
Telephone: Busby 1171.

The Director, The Forest Products Research Laboratory, Princes Risborough, Bucks.
Telephone: Princes Risborough 101.

The Director, The British Standards Institution, 2 Park Street, London, W.1.
Telephone: Mayfair 9000.

The Director, The Building Centre, 26 Store Street, Tottenham Court Road, London, W.C.1.
Telephone: Museum 5400 (10 *lines*).

The Director, The Scottish Building Centre, 425–7 Sauchiehall Street, Glasgow, C.2.
Telephone: Douglas 0372.

Gas and Electrical Appliances. The Ministry of Housing and Local Government have sent to local authorities a circular (50/54) drawing their attention to the latest editions of (*a*) the *List of Tested and Approved Domestic Gas Appliances*, and (*b*) the *List of Tested and Approved Domestic Electrical Appliances*, compiled respectively by the Gas Council and the British Electrical Development Association at the request of the Ministry of Fuel and Power. The Ministry recommend that any gas or electrical appliances installed in houses should be selected from those in the lists.

The list of gas appliances is List No. 3, June 1954, and can be obtained from the Gas Council, 1 Grosvenor Place, London, S.W.1. The electrical booklet is List No. 2, January 1954, to be had from the British Electrical Development Association, 2 Savoy Hill, London, W.C.2.

Standardised Lighting Fittings. After close study of the needs of users, Messrs. Crompton Parkinson Ltd. have produced a 5 ft. fluorescent lighting fitment which, by standardisation of parts, enables 54 varieties of usage to be obtained from stock units. The basic unit is a casing containing the electrical components and wiring to the lampholders, and this unit may be for one lamp or two. The base reflector may be vitreous enamel finish or Permawhite, which is a high-gloss stoved enamel. The top of the unit has several knock-outs, and sliding grooved clips enable the suspending nuts to be fixed anywhere along the top of the unit.

To these basic units can be added (*a*) end plates, either open or closed, attached by captive screws, (*b*) side reflectors resting on the end plates and kept in place by little clips; these reflectors may be closed top or open top, the last allowing light to be cast on the ceiling; and (*c*) an egg-crate louvred fitting which slips into place between the closed type end plates. The side reflectors may be in Permawhite, vitreous enamel or Perspex. The lamp caps are earthed at each end and protected by sliding shields. The lamps themselves can be put in or taken out from either end, or indeed from the middle, as the lampholders have a spring-loaded sliding action.

A refinement in the louvred fitting is that the ends of the transverse strips are cut back at an angle and therefore do not show as a series of black lines on the Perspex side reflectors. If light is required on some wall chart or chalkboard it can be provided by taking away one of the side reflectors.

The result of this standardisation is that with the basic unit fixed in position a variety of lighting effects are possible by simply adding stock components, and all these varieties will have a family resemblance; this would be an advantage if the usage of the premises were to be changed from that for which the installation was originally intended.

Messrs. Crompton Parkinson have given the name *New-Range* to this development in lighting fittings, and inquiries should be addressed to them at Crompton House, Aldwych, London, W.C.2.

Veneered Plywood Panelling and Central Heating. The Timber Development Association have issued a leaflet, reference No. 43, describing the precautions to be taken when installing veneered plywood panelling where there will be central heating. The temperature of a panelled room can be raised from, say, 45 degrees F. to 60 degrees F. in half the time it takes to heat a room without panelling, but certain problems arise about the panelling itself, particularly near radiators.

Plywood itself has a very small movement under changes of moisture content and for all practical purposes it can be considered negligible, but the decorative veneer on the surface is generally of a different wood and thinner than the laminae of which the plywood is made, and therefore a greater surface movement may be produced in the decorative veneer than in the plywood to which it is bonded. Under adverse conditions this may result in hair-checks, and even cause splits in the veneer if a sudden change in atmospheric humidity occurs.

The leaflet gives advice on fitting veneered panels, especially when they are wide, and mentions that hair cracks on the panelling may be cracks in the polish itself and not in the veneer. In this case the remedy is repolishing, but it may require very careful examination to distinguish between these two types of defects. Copies of the leaflet can be obtained, free, from the T.D.A.

Building Topics. An informative booklet is published by Messrs. Tretol Ltd., of 12 North End Road, London, N.W.11. It is called *Building Topics* and deals with the protection and maintenance of buildings. The latest issue, No. 1 of volume 7, contains short articles on the following subjects; painting of alkaline building surfaces; questions and answers on concrete; workability aids for mortar; epikote epoch; paint tinting guide, and a survey of different types of floor seal treatments for timber floors.

The article on workability aids for mortar mentions that such aids have been in common use in the United States for the last decade. To enable a cement/sand mortar to work easily it has been usual to add lime, but as lime expands and cement contracts during hydration there are two opposing stresses set up in the mortar during the drying process, and the result is often crazing and movement of the mortar joints from the brickwork. If some other material than lime could be used with a weak cement and coarse sharp sand mortar, giving the desired workability, an advance in technique would be made, and plasticisers answer the purpose.

As these mortar plasticisers are comparatively cheap and the quantities needed are small, the elimination of lime lessens the building costs, and it has been estimated that for a typical house of 1,000 ft. super the use of a plasticiser instead of lime should result in a saving on construction of about £4 10*s*. on the brickwork alone.

Messrs. Tretol include in their booklet a section regarding their technical inquiry bureau in which they answer inquiries on the subject of the maintenance and protection of buildings, and this service is free.

Perlite Plaster. In the October 1953 issue of the JOURNAL a note was published on Carlite vermiculite plaster. The Gotham Company Ltd. are now producing a Carlite plaster premixed with perlite, 'a name given by geologists to a glassy volcanic rock of concentric shelly structure with the property that its chemical make-up includes a small percentage of combined water. The presence of this combined water allows this mineral to be expanded to many times its original volume.' The expanded material is a lightweight, non-combustible, glass-like bubble of cellular structure, light grey or white in colour.

The close resemblance in nature of perlite to sand gives the plaster free working properties, although it is less than half the weight of sanded plasters. The advantages claimed for perlite-mixed plaster are lightness, freedom from shrinkage cracks, strength to resist severe wear and tear, high thermal insulation value and high fire resistance.

The coverage of an undercoating with perlited Carlite will be increased and therefore the cost per sq. yd. should be reduced.

Particulars may be obtained from the Gotham Company Ltd., of Bentinck Buildings, Wheeler Gate, Nottingham.

Canadian Trend Houses. The Lumber, Plywood and Red Cedar Shingle Manufacturers' Associations of British Columbia have undertaken a nation-wide publicity campaign in Canada to further the use of their west coast woods, and the campaign has taken the very practical form of erecting ten all-timber houses, one each in Vancouver, Edmonton, Calgary, Regina, Winnipeg, London, Toronto, Montreal, Halifax, and Victoria. These they name *Trend Houses*, as 'Canadians from coast to coast are discovering a new trend in modern living. They're discovering a new flexibility of home design that means easier, healthier, more gracious living than ever before. They're discovering a new ease and economy of home building—and home maintenance.'

This trend can be followed in Canada by the use of western woods such as Pacific coast hemlock, western red cedar, Douglas fir plywood, red cedar shingles and sidewall shakes, and their uses in housebuilding are shown in a booklet describing the woods. Each of the ten houses has been designed by an architect or architects and the booklet reproduces the plans together with perspective sketches. Each page containing the plan gives the floor areas and details of what woods have been used in the construction, with the architects' names and a note that complete plans and specifications are available from the architects for 25 dollars.

The 'trend' towards flexibility in planning is not unknown in this country; neither are the woods; nevertheless, architects wishing to know how and where their Canadian fellow practitioners use their native timbers should write to the office of the High Commissioner for Canada, Foreign Trade Service, Canada House, London, S.W.1, for a copy of the booklet; it is free.

Fuel Stores. The Coal Utilisation Council are of opinion that with the advent of improved open fires and other appliances the popularity of solid fuel in the home is likely to increase rather than decrease. But one problem is storage, and if stocks of fuel could be laid in by the householder during the summer months he could get it at a cheaper rate because it would tend to create a steady flow from the mines throughout the year and thereby labour and transport would be most effectively employed.

The Council have therefore produced a booklet, *Fuel Stores for Houses and Flats*, showing various suggestions for fuel stores in houses and flats, designed by the Council, the Cement and Concrete Association, the Timber Development Association, the Solid Smokeless Fuels Federation, and by architects. The booklet is illustrated with plans and detail drawings. It may be obtained from the C.U.C., 3 Upper Belgrave Street, London, S.W.1, price 2*s.* 6*d.*

Stud Welding. Messrs. Crittall Manufacturing Company Ltd. announce a new development in the metal window industry —stud welding. This is a form of metallic arc welding whereby small attachments may be welded to the surface of a metal structure. Messrs. Crittall state that they have used the system successfully in applying fixing bolts to the already erected steel structure of new schools to which metal windows have to be fixed. This means that the structure does not have to be prepared for the windows in advance, and it does away with the need for drilling and tapping holes in the structure, which would not only weaken it to some degree but would also present points at which corrosion might start. As no drilling and tapping has to be done there is some saving in cost.

Flexible Metallic Conduit. There are on the market several forms of electrical wiring which may be called self-contained, as the wires are enclosed in an appropriate and integral covering; there are also several forms of conduit tubing into which the wires have to be threaded. One type of such tubing is called Kopex and is in essence strips of non-elastic metal spirally wound round a paper lining. The spiral formation allows the conduit to be bent round corners and therefore is particularly useful in running additional points in an existing building, especially as it does away with the need for bends and elbow fittings. It is easily cut and can be joined to fittings, inspection and junction boxes by using specially-designed Kopex adaptors. Couplings employ a lead seal in conjunction with a union and locking ring. The metallic sheathing ensures electrical continuity.

Kopex is made in several forms, the standard types being aluminium and lead-coated steel wound round a paper lining. It can be had with a PVC outer covering and there is a special type made to meet marine requirements. Sizes run from $\frac{1}{2}$ in. to 3 in. outside diameter.

Inquiries should be addressed to Messrs. Uni-tubes Ltd., 9 South Molton Street, London, W.1.

Solid Fuel Appliances. The Coal Utilisation Council have issued their List No. 9, July 1954, of recommended domestic solid fuel appliances. It has been prepared in consultation with the Ministry of Fuel and Power and cancels List No. 8 of January last. Enclosed with the booklet is a list of information centres and regional officers. List No. 9 may be obtained from the C.U.C., 3 Upper Belgrave Street, London, S.W.1, price 6*d.*

British Standards Yearbook 1954. The 1954 edition of this useful Yearbook has now been published. It lists some 2,500 British Standards current at 31 March of this year and gives a brief description of the subject-matter of each, with a comprehensive index. Information of the membership of the Institution's General Council, Divisional Councils and Industry Standards Committees is also given, and also the names of representatives on the main special and advisory committees. The price of the yearbook is 12*s.* 6*d.*

British Standards and Model Byelaws. The British Standards Institution announce that the new 1954 edition of the Ministry of Housing and Local Government Model Byelaws, series 21, refers to a list of British Standards which varies from that in the 1949 edition on which B.S. Handbook No. 12, *Water Fittings*, was prepared. Seven of the Standards have been revised, five new ones are included, and one has been omitted. Two Standards, formerly included as appendix A, have been inserted in the main list of Standards.

A collection of the numbers of Standards referred to in the new Byelaws is available as an unbound set at an inclusive price of £3 10*s.* instead of the combined published prices amounting to £5 12*s.*

This special collection may be obtained from the B.S.I. Sales Department and should be referred to as *1954 Water Byelaw Set*.

British Standards Recently Published

B.Ss. 882 and 1201: 1954. **Concrete Aggregates from Natural Sources.** These two Standards have recently been revised, in order to take account of modern developments in the uses of concrete and of national availability and distribution of aggregate materials.

Previously, in B.S. 882, fine aggregates were classified under two grades, A and B, which tended to brand as inferior a large proportion of the fine aggregate from which good concrete can be made, but a proper understanding of concrete mix design enables concrete of equal strength to be made from different gradings of aggregate, and it is important that this fact should be recognised if full economic use is to be made of available materials, especially as a recent survey of the position indicated that in 50 years' time the supply position can be expected to become acute in some areas.

In the revision of B.S. 882, **Coarse and Fine Aggregates from Natural Sources for Concrete,** the classification of fine aggregates is based on their division by grading into four grading zones, the aggregate becoming progressively finer from grading zone 1 to grading zone 4. 'The fine aggregates within each of these zones are suitable for making concrete, but to make concrete of high strength and good durability the mix proportions should be chosen according to the grading characteristics of the fine aggregate used; the ratio of fine to coarse aggregate being reduced as the fine aggregate becomes finer.'

In the revision of B.S. 1201, **Aggregates for Granolithic Concrete Floor Finishes,** the fine aggregate shall be within the limits of two grading zones, 1 and 2.

These revisions of B.Ss. 882 and 1201 are issued as a single publication, price 2*s.* 6*d.*

B.S. 2490: 1954. **Waterproof Drawing Inks.** This Standard is the outcome of extensive investigations carried out among large users in the United Kingdom. Eleven colours were finally selected; violet, Prussian blue, cobalt blue, light green, dark green, yellow, orange, vermilion, scarlet, carmine and brown. Waterproof black carbon inks are included, but only from the point of view of tests of quality.

A warning is given that the colours shown on the chart necessarily appear darker than they would if they were applied as washes on cartridge paper. Price 3*s.*

Membership Lists

ELECTION: 1 FEBRUARY 1955

An election of candidates for membership will take place on 1 February 1955. The names and addresses of the overseas candidates, with the names of their proposers, are herewith published for the information of members. Notice of any objection or any other communication respecting them must be sent to the Secretary, R.I.B.A., not later than Saturday 15 January 1955.

The names following the applicant's address are those of his proposers.

AS ASSOCIATES (18)

Bates: Peter David Patrick, B.Arch. (C.T.) (Passed a qualifying Exam. approved by the I.S.A.A.) c/o Messrs. Ayres, Wilson and Parker, P.O. Box 449, Bulawayo, S. Rhodesia. J. R. Hobson, I. D. MacGillivray, C. A. Knight.

Bosman: Izak Daniel, B.Arch. (Pretoria) (Passed a qualifying Exam. approved by the I.S.A.A.) 14/15 Alliance Building, 104 Cross Street, Kroonstad, O.F.S., S. Africa. Applying for nomination by the Council under Bye-law 3(*d*).

Chamen: Tom Scarnell, B.Arch. (C.T.) (Passed a qualifying Exam. approved by the I.S.A.A.) P.O. Box 137, Lusaka, Northern Rhodesia. O. Pryce Lewis and applying for nomination by the Council under Bye-law 3(*d*).

Collings: Francis Melbourne, Dip.Arch. (Melbourne) (Passed a qualifying Exam. approved by the R.A.I.A.) 25 Arthur Street, Sandringham, Victoria, Australia. Harry Winbush, L. M. Perrott, P. H. Keys.

Downie: Peter Cranch, B.Arch. (Melbourne) (Passed a qualifying Exam. approved by the R.A.I.A.) 185 Pitt Street, Sydney, Australia. Harry Winbush, L. M. Perrott, P. H. Meldrum.

Duncan: Kenneth Shaw, Dip.Arch. (C.T.) (Passed a qualifying Exam. approved by the I.S.A.A.) 'Brookfield', 25 Grotto Road, Rondebosch, Cape Town, S. Africa. Prof. L. W. T. White, O. Pryce Lewis and applying for nomination by the Council under Bye-law 3(*d*).

Grant: John Stanley Allison, A.S.T.C. (Arch.) (Passed a qualifying Exam. approved by the R.A.I.A.), c/o Messrs. Palmer and Turner, Banque de l'Indochine, d'Almeida St., Singapore, Malaya. H. L. Bloomfield, D. S. Petrovitch, K. A. Brundle.

Gunter: Derek Colin (Passed a qualifying Exam. approved by the N.Z.I.A.), 19 Homewood Avenue, Karori, Wellington, New Zealand. J. M. Scott, J. I. King, R. E. Enthoven.

Hesketh: John Hesketh, M.B.E. [Arch. Assoc. (London): Sch. of Arch.], Trust Buildings, Gardiner Street, Durban, S. Africa. A. M. Allen, Arthur Korn, R. F. Jordan.

Ho: Kok Yin, A.S.T.C. (Arch.) (Passed a qualifying Exam. approved by the R.A.I.A.), 35 Yan Kit Road, Singapore, 2. Prof. F. E. Towndrow, Cobden Parkes, W. R. Laurie.

Loewenstein: Hillery Gerald, B.Arch. (Rand) (Passed a qualifying Exam. approved by the I.S.A.A.), 'Seven Poplars', 57 7th Avenue, Highlands North, Johannesburg, S. Africa. Applying for nomination by the Council under Bye-law 3(*d*).

Moross: Hyman, B.Arch. (Rand) (Passed a qualifying Exam. approved by the I.S.A.A.), 405 M.B.S. Building, Wolmarans Street, Johannesburg, S. Africa. Applying for nomination by the Council under Bye-law 3(*d*).

Murray: Graham Benjamin, Dip.Arch. (Auck. N.Z.) (Passed a qualifying Exam. approved by the N.Z.I.A.), 82 Karangahape Road, Auckland, C.2, New Zealand. C. R. Ford, W. H. Gummer, Prof. C. R. Knight.

Sayers: David Alan (Passed a qualifying Exam. approved by the N.Z.I.A.), c/o Architects Department, Public Works Department, Wellington, New Zealand. R. H. Uren, J. A. Slater, J. M. Easton.

Skacel: George, B.Arch. (C.T.) (Passed a qualifying Exam. approved by the I.S.A.A.), 501 Trafalgar Place, Regent Road, Sea Point, Cape Town, S. Africa. O. Pryce Lewis, Prof. L. W. T. White, H. L. Roberts.

Slawik: Zygmunt Bernard (Passed a qualifying Exam. approved by the R.A.I.A.), 125 Bambra Road, Caufield, Victoria, Australia. Harry Winbush, C. E. Serpell, J. F. D. Scarborough.

Steinberg: Richard Geoffrey, B.Arch. (Rand) (Passed a qualifying Exam. approved by the I.S.A.A.), 308, Roxdale, 2nd Avenue, Houghton, Johannesburg, S. Africa. Applying for nomination by the Council under Bye-law 3(*d*).

Vandermeulen: Jan Willem, B.Arch. (C.T.) (Passed a qualifying Exam. approved by the I.S.A.A.), 'Nieuwelings', P.O. Box 84, Adelaide, Cape Province, S. Africa. Prof. L. W. T. White and applying for nomination by the Council under Bye-law 3(*d*).

Notes and Notices

NOTICES

Inaugural General Meeting, Tuesday 2 November 1954 at 6 p.m. The Inaugural General Meeting of the Session 1954–55 will be held on Tuesday 2 November 1954 at 6 p.m. for the following purposes:—

To read the minutes of the Eighth General Meeting of the Session 1953–54 held on 15 June 1954;

Mr. C. H. Aslin, C.B.E., President, to deliver his Inaugural Address;

To unveil the portrait of Sir Howard Robertson, M.C., A.R.A., S.A.D.G., Past President, by Professor R. Moynihan, C.B.E., A.R.A.

To present the London Architecture Bronze Medal 1953 to Messrs. Devereux and Davies [*FF*] for the New Out-Patients' Building, St. James' Hospital, Balham, S.W.17.

(Light refreshments will be provided before the meeting.)

Classes of Retired Members. Under the provisions of Bye-law 15 applications may be received from those members who are eligible for transfer to the class of 'Retired Fellows', 'Retired Associates' or 'Retired Licentiates'.

The Bye-law is as follows: 'Any Fellow, Associate or Licentiate who has reached the age of 55 and has retired from practice may, subject to the approval of the Council, be transferred without election to the class of "Retired Fellows", "Retired Associates", or "Retired Licentiates", as the case may be, but in such case his interest in, or claim against the property of, the Royal Institute shall cease.

'The amount of the annual subscription payable by such "Retired Fellow", "Retired Associate" or "Retired Licentiate" shall be one guinea, or such amount as may be determined by resolution of the Council, excepting in the case of those who have paid subscriptions as full members for 30 years, and who shall be exempt from further payment. A "Retired Fellow", "Retired Associate" or "Retired Licentiate" shall have the right to use the affix of his class with the word "Retired" after it, shall be entitled to receive the JOURNAL and Kalendar, shall be entitled to the use of the Library, and shall have the right to attend General Meetings, but shall not be entitled to vote. A "Retired Fellow", "Retired Associate" or "Retired Licentiate" shall not engage in any avocation which in the opinion of the Council is inconsistent with that of architecture. Nothing contained in this Bye-law shall affect the rights of persons who at the date of the passing of this Bye-law are members of the classes of "Retired Fellows" and "Retired Members of the Society of Architects".'

Formal Admission of New Members at General Meetings. New members will be asked to notify the Secretary R.I.B.A. beforehand of the date of the General Meeting at which they desire to be introduced and a printed postcard will be sent to each newly elected member for this purpose. On arrival at the R.I.B.A. on the evening of the General Meeting new members must notify the office of their presence and will then take their places in the seats specially numbered and reserved for their use. On being asked to present themselves for formal admission, the new members will file out in turn into the left-hand aisle and after shaking hands with the President (or Chairman) will return to their seats by way of the centre aisle.

Formal admission will take place at all Ordinary General Meetings of the present Session, with the exception of the following:—
2 November 1954: Inaugural General Meeting.
1 February 1955: Presentation of Prizes.
5 April 1955: Presentation of Royal Gold Medal.

Disciplinary Action. Mr. Basil Ian Briggs, of 7 Station Chambers, Station Parade, High Street North, East Ham, London, E.6, an Associate, was suspended from membership of the Royal Institute for a period of one year, by a decree of the Council dated 12 October 1954 made pursuant to the Bye-laws.

CURRENT R.I.B.A. PUBLICATIONS

The following is a list of main R.I.B.A. publications with their prices.

Agreement, Forms of

Form of Agreement for General Use between a Private Building Owner and an Architect or a Firm of Architects.

Form of Agreement for General Use between a Building Owner (being a Statutory Authority) and an Architect or a Firm of Architects.

Form of Agreement between a Local Authority and a Firm of Architects for Housing Work.

Form of Agreement between a Local Authority and a Firm of Architects for Multi-Storey Flats.

Form of Agreement between the Promoters and a Firm of Architects appointed as the Result of a Competition.

Price 6*d.* per form (inclusive of purchase tax). Postage 3*d.*

Architect and His Work, The
Price 6*d*. Postage 3*d*.

Before You Build. Free.

Certificates, Architects', Form Prepared by the Practice Committee
Copyright. Book of 100 Certificates.
Price 17*s*. (inclusive of purchase tax). Postage 1*s*. 1*d*.

Conditions of Engagement and Scale of Professional Charges
Price 6*d*. Postage 3*d*.

Contract, Form of Agreement and Schedule of Conditions
For use with quantities: 1939 revised 1952. Copyright.
For use without quantities: 1939 revised 1952. Copyright.
Price 2*s*. 2*d*. per form (inclusive of purchase tax). Postage 3*d*.
Adapted for the use of Local Authorities, for use with quantities: 1939 revised 1952. Copyright.
Adapted for the use of Local Authorities, for use without quantities: 1939 revised 1952. Copyright.
Price 2*s*. 4½*d*. per form (inclusive of purchase tax). Postage 3*d*.
Fixed Fee Form of Prime Cost Contract for use in the repair of war-damaged property, 1946 revised 1950. Copyright.
Price 2*s*. 2*d*. (inclusive of purchase tax). Postage 3*d*.
Cost Plus Percentage Form of Prime Cost Contract for use in the repair of war-damaged property: 1946 revised 1950. Copyright.
Price 2*s*. 2*d*. (inclusive of purchase tax). Postage 3*d*.

Examination, Intermediate, Questions Set At
Price 1*s*. per examination. Postage 3*d*.

Examination, Professional Practice, Questions Set At
Price 6*d*. Postage 3*d*.

Examinations, Final and Special Final, Questions Set At
Price 1*s*. per examination. Postage 3*d*.

Forms of Articles of Pupilage
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Party Wall Notice Forms, for Use Under the London Building Act
Form A—Party Structures.
Form B—Party Fence Walls.
Form C—Intention to Build within Ten Feet and at a lower level than the bottom of the foundations of adjoining Owner's Building.
Form D—Intention to build within Twenty Feet of the adjoining Owner's Independent Building and to a depth as defined in Section 50 (1) (*d*).
Form E—Party Walls and Party Fence Walls on line of Junction of adjoining lands.
Form F—Walls or Fence Walls on Building Owner's land with footings and foundations projecting into adjoining Owner's land.
Form G—Selection of Third Surveyor.
Price 7*d*. per form (inclusive of purchase tax). Postage 3*d*.

COMPETITIONS

Church and Church House at Liverpool. The Liverpool Diocesan Reorganisation Committee invites architects to submit designs in competition for a new Church House and Chapel on the site of St. Luke's Church, Berry Street, Liverpool.
Assessor: Sir Giles Gilbert Scott, O.M., R.A. (Past-President).
Premiums: £800, £400, £200.
Last day for submitting designs: 16 December 1954.
Conditions may be obtained on application to P. Straw, Secretary, Liverpool Diocesan Reorganisation Committee, Church House, 47 Moorfields, Liverpool, 2.
Deposit, £2 2*s*. 0*d*.

Dow Prize Competition. The Illuminating Engineering Society offers a prize which will be awarded to the winners of a competition intended to encourage collaboration between students of illuminating engineering or of those branches of engineering concerned with illumination, and students in other fields in which applied lighting plays an important part. While entries from individuals are not excluded, the competition is primarily intended for students (under the age of 26) working in collaboration. The competition will be set and judged by a panel of assessors appointed by the Society in co-operation with the R.I.B.A. and the Institution of Electrical Engineers.
Premium: £75 (and a certificate to each member of the winning team).
Certificates of commendation will be awarded to any other entries of outstanding merit.
Last day for submitting designs: 15 November 1954.
Forms of application and instructions as to the form which entries should take may be obtained from the Secretary of the Illuminating Engineering Society, 32 Victoria Street, London, S.W.1.

BOARD OF ARCHITECTURAL EDUCATION

R.I.B.A. (Archibald Dawnay) Scholarships 1954–55. The R.I.B.A. (Archibald Dawnay) Scholarships for 1954–55 have been awarded as follows: A scholarship of £60 to C. E. Hanley of the Birmingham School of Architecture. A scholarship of £60 to P. Willis of the School of Architecture, King's College, Newcastle. A scholarship of £60 to A. J. Tomlinson of the Nottingham College of Art and Crafts. A renewal of the scholarship of £60 awarded for the session 1953–54 to D. J. Downes of the Welsh School of Architecture, The Technical College, Cardiff. A renewal of the scholarship of £60 awarded for the session 1953–54 to A. G. Giffen of the Edinburgh College of Art.

R.I.B.A. Final Examination. Distinction in Thesis. Geoffrey J. Thomas of Guildford, Surrey, who passed the Final Examination in December 1950, has been awarded a mark of Distinction for his Thesis.

ALLIED SOCIETIES

Changes of Officers and Addresses
Northern Architectural Association, Tees-side Branch. Chairman, Mr. P. R. Middleton, Dip. Arch. [*A*], Court Chambers, Albert Road, Middlesbrough.

Royal Architectural Institute of Canada. Hon. Secretary, Mr. Maurice Payette, F.R.A.I.C., 6535 rue des Encores, Montreal 36, P.Q., Canada.

South Australian Institute of Architects. The address of the Institute is now 12 Pirie Street, Adelaide.

Natal Provincial Institute of Architects. President, Mr. Keith E. Gow [*A*].

Transvaal Provincial Institute of Architects. President, Mr. C. M. Sinclair [*A*].

Indian Institute of Architects. New Joint Hon. Secretary, Mr. A. S. Patil [*A*], Messrs. B. Mhatre Patil & Co., 3rd Floor, Bombay Mutual Building, Hornby Road, Bombay. Mr. Patil replaces Mr. P. J. Khambata [*A*].

Berks, Bucks and Oxon Architectural Association. Annual Dinner. The annual dinner of the Berks, Bucks and Oxon Architectural Association was held at St. John's College, Oxford, by kind permission of the President and Fellows, on Friday 24 September. The President of the Association, Mr. David Booth [*F*], was in the Chair, and among the guests were Mr. C. H. Aslin, C.B.E., President R.I.B.A., and Mrs. Aslin; the Mayor and Mayoress of Oxford; the Presidents of St. John's and Magdalen Colleges; Mr. H. M. Colvin, Fellow of St. John's College, author of the recently published *Biographical Dictionary of English Architects 1660–1840*; and representatives of the building trades and allied professions.

Mr. Booth, proposing the toast of the R.I.B.A., remarked on the great change that had come over building since the Institute was founded. He thought technical control of building was more efficient now than it had ever been but more complicated. To deal with this complexity private architects should work in larger groups, thus allowing more scope for specialisation. On the other hand the offices of public architects tended to be unwieldy and might well be sub-divided. The art of design had lagged behind technical development, but during the last ten years there had been real progress in this respect—nowhere more evident than in Mr. Aslin's Hertfordshire schools.

The President R.I.B.A., replying, said this was his first Allied Society dinner since taking office. In a charming and witty speech he touched on a number of subjects. He said he thought the Roman Temple in the City of London should be preserved, if necessary at public expense; that building development since the war had been lop-sided, the greater part of it having been for public authorities; that this would not always be so and that it was essential for the good of the profession that private architects should have a fair share of the work; and that the art of architecture was the first charge of the R.I.B.A.

Mr. R. W. Cave [*A*], Chairman of the Oxfordshire Society of Architects and Head of the Oxford School of Architecture, proposed the health of the guests, and the Mayor of Oxford and the President of Magdalen replied. The latter warned against an undiscriminating admiration for all that was old, much of which was by no means good. Undue reverence for the past could have a stultifying effect on modern architecture.

Wessex Federal Society of Architects' Golfing Society. The autumn meeting of the Wessex Federal Society of Architects' Golfing Society took place at Knowle Golf Club, Bristol, on Saturday 2 October. The weather conditions were excellent and the game took the form of medal play against handicap. Seven cards were returned and the lowest score was made by Mr. B. Ivor Day with 73 net. The runner-up was Lt.-Col. Eric Cole with a net score of 74.

After luncheon the Eric Cole Silver Challenge Cup was presented to the winner and at a subsequent meeting of the Society the following officers were nominated for the ensuing year: President, Lt.-Col. Eric Cole; Captain, Mr. B. Ivor Day; Hon. Secretary, Mr. T. W. Snailum.

It was agreed that the Society should have four meetings each year, to include two matches, and that the cup should be played for again at the next autumn meeting.

Obituaries

John Pollard, F.R.I.C.S. [*L*], died on 2 August, aged 58.

Mr. Pollard was Borough Architect and Borough Engineer and Surveyor, Middleton, Lancs. During his term of office he was responsible for the erection of about 2,000 houses and flats in the town, also the public baths, electricity and gas showrooms, a health centre and a crematorium and for the redevelopment of the town centre. He drew up the town's post-war development plan.

Francis Edwin Spencer Munt [*A*] died on 7 July, aged 69.

In recent years Mr. Munt had ceased to practise, except for occasional commissions for friends, since his work as director of the St. James's Secretarial College, which he founded, took all his time. In earlier years he had been employed in the Architectural Department of New Scotland Yard and he was the designer of the war memorial at Shere, near Guildford, Surrey.

Donald Walker Mackereth [*Student*] died on 25 August, aged 40. Bad health, thought to be largely the result of his wartime experiences, had prevented him from sitting for the Final Examination. He served in the Royal Corps of Signals during the war, was taken prisoner at Tobruk and spent the remainder of the war in prison camps in Italy and Austria.

Mr. Mackereth was articled in Manchester and joined Messrs. Halliday & Agate, Manchester, in 1935, remaining with them until his death. He passed the Intermediate Examination in 1938. Mr. F. Leslie Halliday, A.M.T.P.I.[*F*], writes of him: 'He was an enthusiastic student of domestic work, and was happiest when working upon private houses and housing schemes, of which he had considerable experience. He was a cheerful and lovable character, and bore a long illness with courage and fortitude. He was keen upon all aspects of an architect's work, and he will be sadly missed by a wide circle of friends.'

Arthur Willmott Addison [*Retd. A*] died on 15 August, aged 90.

Mr. Addison worked on repairs and extensions to various colleges and churches in Cambridge and was Architect to Lichfield Rural District Council.

Arthur Henry Salisbury [*L*] died on 9 August, aged 73.

Mr. Salisbury served his articles and for a time practised in London. During World War I he was chairman of Morgan's Aircraft Ltd., at whose factory at Leighton Buzzard many of the earliest types of wartime aircraft were manufactured. He later moved first to Kent and then to Hampshire. His great architectural interest was in the restoration of old houses and churches, and Bramshott Manor, where he now lived, gave great scope for the exercise of his gifts. By patient investigation he recovered many of the ancient features of the house, including the stone which dates the original building as early 13th century. He was also much interested in the care of local churches and in local genealogies and antiquities, on which he contributed a number of articles to the local press. He was a member of the Winchester and Portsmouth Advisory Committee for the Care of Churches and later became one of the original members of the Portsmouth Diocesan Advisory Committee. He was for some ten years a member of Petersfield Rural Council.

Frank Hearn Shayler [*Retd. F*] died in July, aged 87.

Mr. Shayler was articled to Mr. E. L. Elgar in Ramsgate and began practice in 1891 in London. From about 1895 onwards he practised in Oswestry, Welshpool and Shrewsbury, and from 1930 onwards in Shrewsbury only.

His practice was largely domestic at first, but he was a highly successful competition entrant, and among his works as a result of this are the Welshpool and Llanfair County Schools, Shrewsbury Secondary Schools (with Mr. J. A. Swan [*F*]), Wellington Secondary Schools (with Swan & Ridge), Bridport Hospital (with E. R. Bill [*A*] and Ellesmere Wesleyan Chapel (with T. Ridge [*A*]). He also built Rhyl County School and numerous premises for the London and Provincial Banking Co. Ltd. and the National Provincial Bank of England Ltd. He was for a time in partnership, first with F. Milverton Drake [*A*] and more recently with Mr. J. Stuart Dilks [*A*].

Hedley Cecil Quérée [*Retd. L*] died on 19 July, aged 77.

Mr. Quérée was articled in his native Jersey to the late W. P. Proper, spent a few years in London as assistant, and then returned to Jersey to set up practice. This was at first largely domestic but later became mostly commercial. It included the Springfield Agricultural Hall in reinforced concrete and a Methodist chapel in granite. He retired from practice in 1948, leaving his former partner, Mr. P. B. Swain [*A*], to carry on.

Mr. Quérée had been a Freemason since 1911 and was Master of two lodges, one being La Césarée, believed to be the oldest French-speaking lodge under the English Constitution. In 1951 he had the rank of Past Assistant Grand Superintendent of Works conferred on him. He was also a Knight Templar.

Major-General Sir Charles Rosenthal, K.C.B., C.M.G., D.S.O., V.D. [*F*], died on 11 May at his home near Gosford, N.S. Wales. He was aged 79.

Sir Charles was born at Berrima, N.S.W., and practised as an architect in Western Australia, Melbourne and Sydney. He was a past president of the Federal Council of the Royal Australian Institute of Architects and for four years president of the N.S.W. Chapter. He was elected Associate of the Royal Institute in 1904 and Fellow in 1922.

He had a distinguished record of service in the first world war. He was mentioned in despatches seven times and, in addition to his other decorations, was awarded the Belgian Croix de Guerre with palms. He was one of the first brigade commanders ashore in the Anzac landing at Gallipoli and is remembered for his gallantry and determination in establishing batteries in the face of murderous fire from the Turks, all previous efforts to do so having failed. In France, after commanding his artillery at the Somme, Bullecourt and Ypres, he was transferred to the leadership of the 9th Infantry Brigade in time for the Passchendaele battle. In all, he was wounded four times and gassed once.

After his return to civilian life he supported many movements for the welfare of returned soldiers. He represented Bathurst in the Legislative Assembly from 1922 to 1925, was for three years an alderman of the Sydney City Council and was later elected to the Legislative Council. He was Administrator of Norfolk Island in the South Pacific from 1937 to 1945 and was for four years president of the Australian Museum, Sydney.

William Bunter Colthurst [*A*] died on 17 September, aged 73. His death occurred suddenly after a picnic on the Quantock Hills in the county of Somerset where he lived.

Mr. Colthurst served his articles with Mr. F. W. Roberts of Taunton and after periods as assistant in Nottingham, Bolton, Lichfield and Brighton started his own practice in Bridgwater and Taunton in partnership with Mr. H. O. Samson [*L*]. This partnership lasted until Mr. Colthurst's retirement in 1950, and in 1945 Mr. L. G. Steer [*A*], who had been their assistant for many years, also became a partner. He now carries on the practice, together with Mr. R. Shirley-Smith, B.Arch., A.M.T.P.I. [*A*].

Mr. Colthurst carried out housing schemes for the Bridgwater and Taunton Corporations and designed schools at Burnham and Highbridge, additions (music school and classrooms) to Taunton School, a new wing to Bridgwater Hospital, the Westminster Bank at Tiverton, the King Street Methodist Memorial Hall at Bridgwater and public-houses at Glastonbury, Bridgwater and Taunton. He travelled much in his early years and made extensive studies of wood and stone carving and of wrought ironwork and had specialist knowledge of the restoration of old buildings.

Mr. L. G. Steer writes of his old employer and partner: 'He was a great reader of wide and catholic tastes, a connoisseur of painting, china and furniture, a keen bee-keeper and gardener and an excellent all-round naturalist, and these interests, combined with remarkable kindliness and a delightful sense of humour, endeared him to a very wide circle of friends.'

George Willis Grey [*F*] died in January 1954, aged 76.

Mr. Grey, author of *Building Supervision*, practised in Hong Kong. One of the buildings with which his name is associated (in partnership with Mr. J. Bentley Hawker) is the Peninsula Hotel, Kowloon.

Mr. Grey served in the South African war and the first world war. During the second world war, being a member of the Hong Kong Volunteers, he was interned by the Japanese.

Members' Column

This column is reserved for notices of changes of address, partnership and partnerships vacant or wanted, practices for sale or wanted, office accommodation, and personal notices other than of posts wanted as salaried assistants for which the Institute's Employment Register is maintained.

APPOINTMENTS

Mr. C. C. Robinson, A.A.Dipl. [*A*], has taken up an appointment with the Government of the Gold Coast and his address is now c/o Tema Development Corporation, Private Post Bag, Accra, Gold Coast.

Mr. Peter H. M. Stevens [*A*] has been appointed Town Planner on the staff of the Housing Adviser to the Colonial Office, Colonial Liaison Section, Building Research Station, Garston, Herts.

PRACTICES AND PARTNERSHIPS

Mr. H. J. Ashwell [*F*] has taken into associate partnership Mr. A. A. Dunn, A.A.Dipl. [*A*]. The firm, formerly known as Ashwell & Rhodes, will now be known as Harold J. Ashwell & Associates and will continue at its old address of 144 Hope Road, Liguanea P.O., Jamaica, B.W.I.

Mr. Alan C. Bishop [*A*] has taken over the practice of Mr. T. W. Taylor [*A*] at Yorkshire Penny Bank Chambers, Market Square, Retford, Notts., and will practise from that address.

The partnership of **Blenkinsopp and Thompson** [*A/F*] has been dissolved by mutual consent. **Mr. G. L. Thompson** [*F*] will continue the practice at Clifton Chambers, Park Street, Selby, under his own name and also from his new office at 16 New Walk Terrace, York, where he will be pleased to receive trade catalogues.

Mr. T. Devlin, B.Arch. [*A*], has begun practice in association with Mr. S. R. Devlin, M.I.Mech.E., M.I.Loco.E. The firm will practise under the title of **T. Devlin and S. R. Devlin,** Architects and Consulting Engineers, at 117 Fishergate, Preston, Lancs. They will be pleased to receive trade catalogues.

Mr. A. Edward Jones [*A*] has entered into the partnership of Stucke, Harrison, Ritchie and Watson, practising at 14 Boston House, Strand Street, Cape Town, S. Africa, P.O. Box 3877, Cape Town.

Mr. C. S. Kimpton [*F*] has taken into partnership **Mr. David Freeman** [*A*]. The practice formerly known as C. S. Kimpton will continue under the name of **Kimpton and Freeman** at Mount Lodge, Sunningdale, Berks. (Ascot 300). Mr. David Freeman has resigned his appointment to the Bracknell Development Corporation.

Mr. Frederick MacManus [*F*] has taken into associate partnership **Mr. Brian Smith** [*A*]. The practice will be continued as previously under the style of **Edward Armstrong and Frederick MacManus,** Chartered Architects, from No. 28 Gloucester Place, Portman Square, W.1 (WEL. 2273–4).

Mr. J. A. McMorland, D.A.(Edin.) [*A*], has relinquished his appointment with Mr. Hugh Walker, M.C. [*A*], of 25 Hout Street, Cape Town, and has joined Mr. J. B. Collins [*A*] at United Building, Plein Street, Stellenbosch, Cape Town, South Africa.

Mr. Philip R. Middleton, Dip.Arch. [*A*], has begun practice at Norwich Union House, 17–19 Albert Road, Middlesbrough, Yorks., and will be pleased to receive trade catalogues.

Mr. Kenneth Scott, M.C. [*A*], has retired from the partnership of James Cubitt Scott and Partners, Accra, Gold Coast, by mutual consent. The partnership will continue to practise under that style and Mr. Scott has opened a practice in Accra under his own name. The address is Private Post Bag, Accra, where he will be pleased to receive trade catalogues, etc.

Mr. Kevin S. Winterbottom [*A*] has taken into partnership Mr. J. O. Knight [*A*] and they will practise under the name of Winterbottom and Knight at 159 Mann Street, Gosford, N.S.W., Australia.

CHANGES OF ADDRESS

The address of **Mr. A. S. Bright** [*A*] is now Universidad de Los Andes, Calle 18A Carrera 1E, Apartado-Aereo 4976, Bogota, Colombia, where he will be happy to receive trade papers, etc.

The address of **Mr. Philip V. Brown** [*A*] is now 24 West Mall, Clifton, Bristol, 8.

The address of **Mr. E. G. Elliott,** A.M.T.P.I. [*A*], is now 52 Sherrardspark Road, Welwyn Garden City, Herts.

The address of **Mr. Leonard Gwilt** [*A*] is now c/o Sergio Larrain G. M./Emilio Duhart H., Arquitectos, Miguel De La Barra 536, Santiago, Chile.

Mr. Denis R. Harper, Ph.D., A.M.T.P.I. [*F*], formerly of Fineshade Abbey, nr. Corby, has changed his address to 28 Gainsborough Road, Corby, Northants.

Mr. George E. Harris [*L*] has removed to 43 Fairfax Road, Bedford Park, W.4 (CHIswick 5858).

Messrs. Harrison, Barnes and Hubbard have moved their offices to No. 2 Lord North Street, Westminster, S.W.1.

Messrs. Hill and Allum [*F*] have removed to 21 Carlton Crescent, Southampton.

Mr. H. N. Mason, B.Arch. [*A*], has moved to 13 Little Chester Street, London, S.W.1 (SLOane 0944).

Mr. K. Bradley Miller, T.D., Dip.Arch. [*A*], has moved his offices to Devereux House, Church Hill, Coleshill, Birmingham (Coleshill 2353), where he will be pleased to receive trade catalogues, etc.

Mr. A. S. MacKenzie [*A*] has moved to 84 Eton Place, Dumbarton Road, Duntocher, Glasgow.

Mr. J. Milnes-Smith [*A*] and **Mr. R. A. B. Hitch** [*A*] have moved their office to 3 Raymond Buildings, Gray's Inn, London, W.C.1.

Mr. Ivan Morris [*A*] has now moved to 36 Brocklehurst Avenue, Norton, Sheffield 8.

Mr. C. B. Moss [*A*] has begun private practice in Australia. His address is Messrs. Moss and Nelson, Courier Building, Queen Street, Brisbane, Queensland, Australia.

Mr. John Powell, Dip.Arch. [*A*], is now at 11 Templar House, Shoot-up-Hill, London, N.W.2 (GLAdstone 7935).

Mr. James V. T. Scott, A.M.T.P.I. [*A*], will transfer his offices to 30 College Gardens, Belfast, Northern Ireland, on 1 November. The new telephone number will be Belfast 31344/5.

Mr. Ian B. Simpson [*F*] has now moved to 2399 West 35th, Vancouver, B.C., Canada.

Mr. E. Slatter, Dip.Arch., A.M.T.P.I. [*A*], has now moved to 61 Kirby Road, Barstable, Basildon, Essex.

PRACTICES AND PARTNERSHIPS WANTED AND AVAILABLE

Associate (39) returning to U.K. from abroad in December wishes partnership or post leading thereto in south or south-east England. Varied experience at home and abroad. Some capital available. Box No. 85, c/o Secretary, R.I.B.A.

Associate (Dip. Arch.), aged 34, already running own practice, seeks partnership in general practice, preferably in an industrial area, or position leading thereto. Capital available. Box 99, c/o Secretary, R.I.B.A.

Licentiate, school and office training, age 41, seeks partnership or position leading thereto. Some capital available. Experience in commercial, industrial, and licensed premises; some acquaintance landed estate work; extensive knowledge alterations and maintenance. North or midlands preferred, but not essential. Box 100, c/o Secretary, R.I.B.A.

Associate with extensive varied experience seeks partnership or position leading thereto in busy practice in South Devon. Some capital available. Box 103, c/o Secretary, R.I.B.A.

Associate, 39, returning from East Africa in late 1954, seeks partnership or position leading thereto in any busy office. County town preferred. Some capital available. Box 104, c/o Secretary, R.I.B.A.

Firm of architects and surveyors [*F/L*] with established practice desire to acquire branch office in growing district or in collaboration with architect considering early retirement. Box 105, c/o Secretary, R.I.B.A.

Associate with varied experience of private practice over the past 15 years and with connections in North London seeks partnership or position leading thereto. Some capital available. Box 107, c/o Secretary, R.I.B.A.

Associate (30), ex-articled pupil, 13 years' varied experience, including management of a branch office in the north, seeks partnership with an established firm in the south or south-west. Capital available. Would purchase practice outright or where principal wishes to retire with financial interest. Highest references available. Replies treated in strict confidence. Box 108, c/o Secretary, R.I.B.A.

Fellow with wide experience at home and abroad wishes to take up partnership in West End or Home Counties firm, of some establishment and with some scholarly approach to architecture. Capital available. Box 110, c/o Secretary, R.I.B.A.

WANTED AND FOR SALE

Wanted. Box of 6 in. Stanley's pre-war instruments. Box 101, c/o Secretary, R.I.B.A.

For sale. Four-drawer steel double elephant plan chest by Milners, with base. Very good condition. Box 106, c/o Secretary, R.I.B.A.

Architect retiring from West End practice has office furniture, drawing boards, etc., for sale. Ring Museum 8544 or write Box 109, c/o Secretary, R.I.B.A.

ACCOMMODATION

London firm [*F/A*] require additional office accommodation of about 600 sq. ft. in or near Bloomsbury Square, W.C.1. Box 102, c/o Secretary, R.I.B.A.

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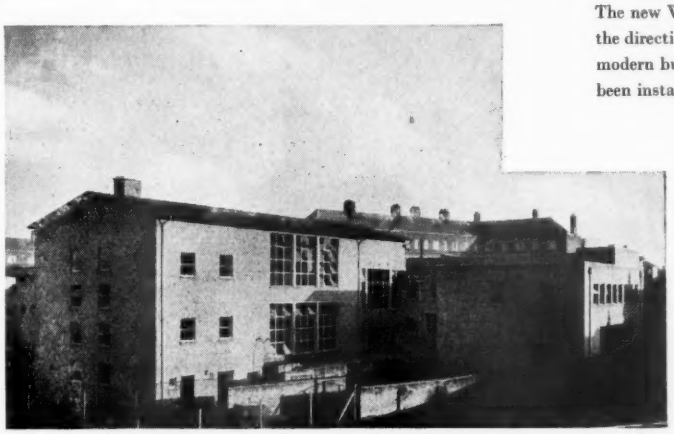
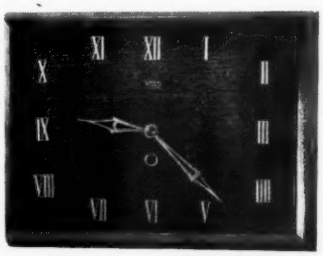


General view of School

Entrance to Assembly Hall



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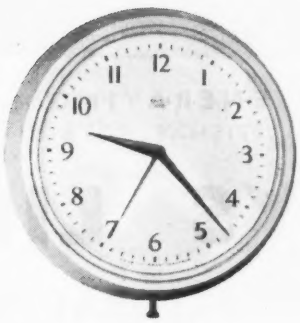

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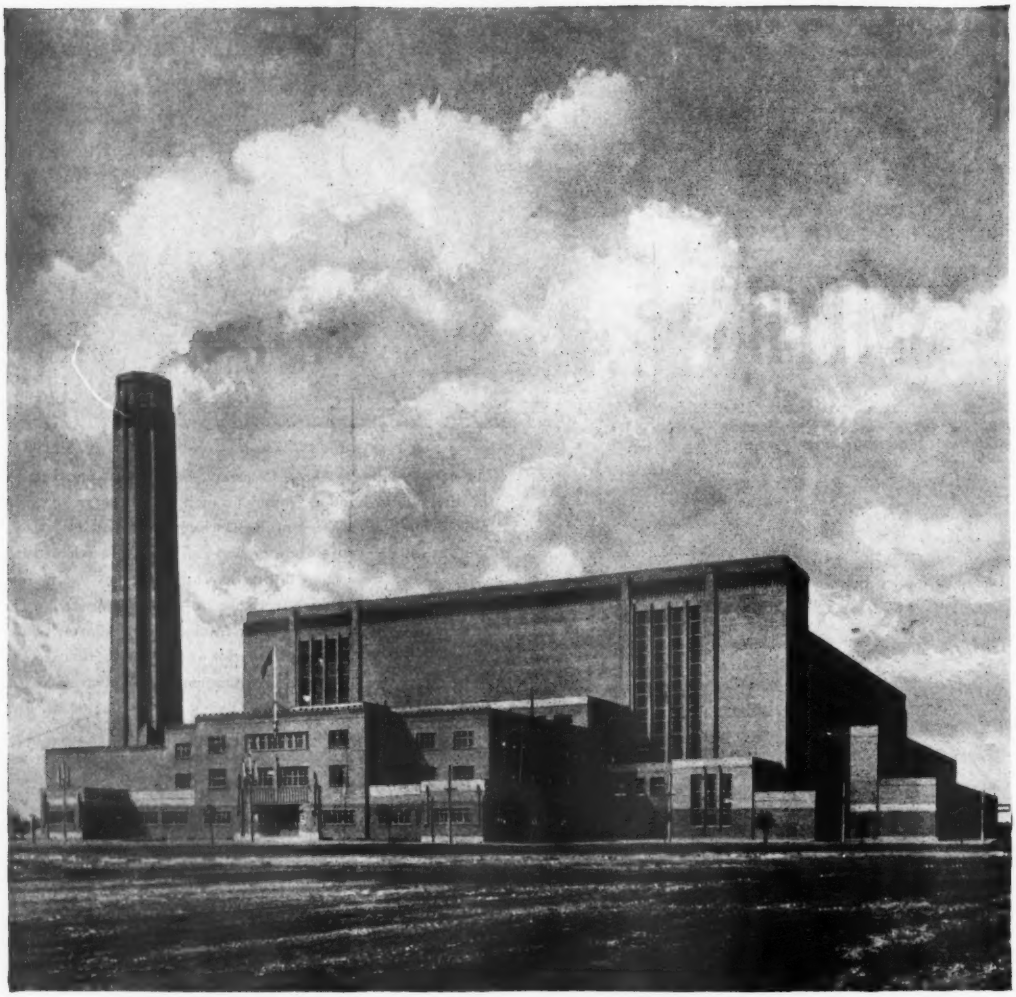

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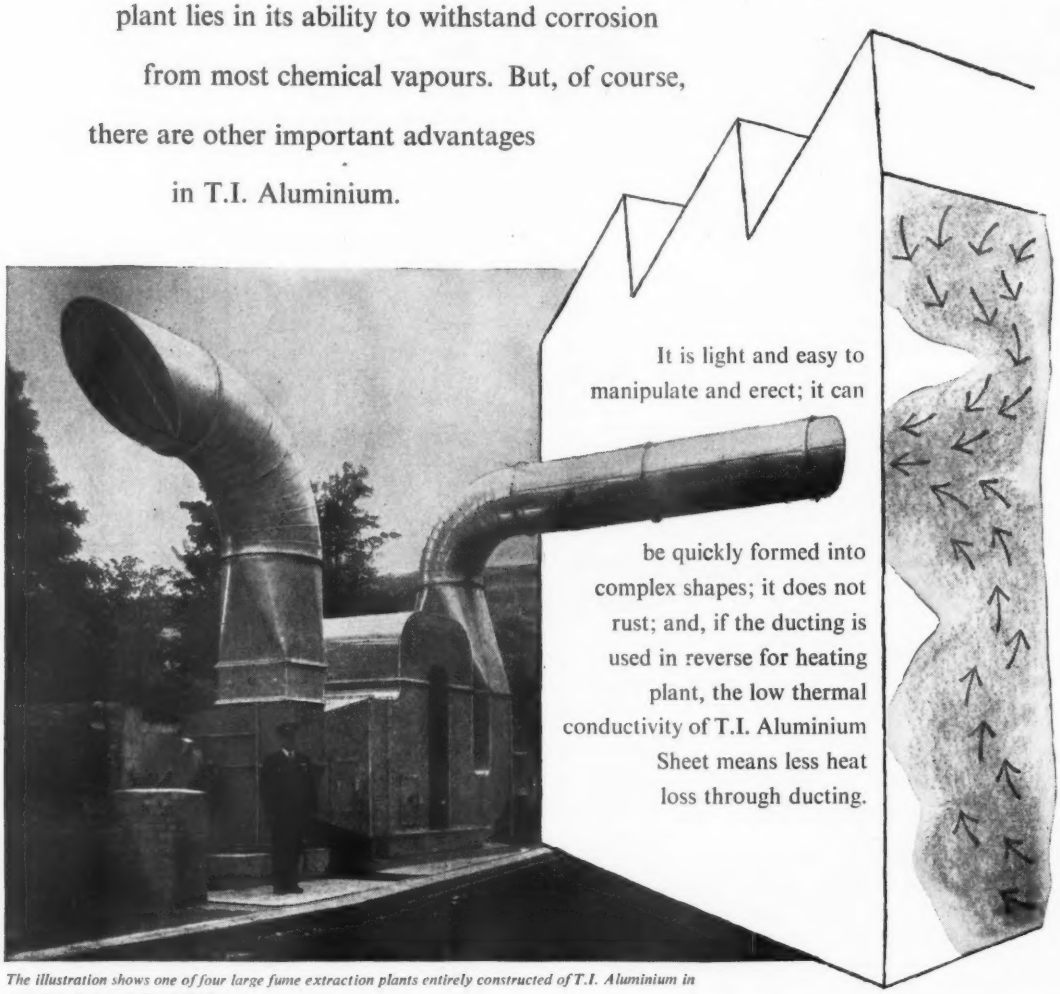

It is light and easy to manipulate and erect; it can be quickly formed into complex shapes; it does not rust; and, if the ducting is used in reverse for heating plant, the low thermal conductivity of T.I. Aluminium Sheet means less heat loss through ducting.

The illustration shows one of four large fume extraction plants entirely constructed of T.I. Aluminium in a modern factory in South Wales.

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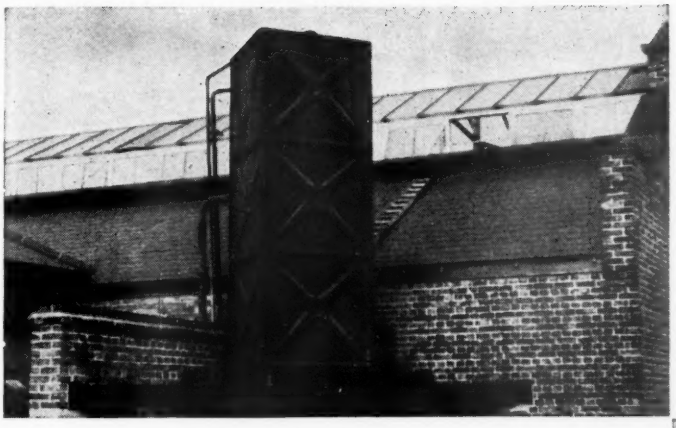

These Braithwaite Pressed Steel Tanks store hot water, cold water and fuel oil. They are sited in positions inaccessible to most other forms of construction. With an unlimited range of capacities Braithwaite Sectional Tanks can be used for most storage needs and are in service for the storage of whey, ammoniacal liquor, fruit juice, creosote, cocoa butter, wine, edible pulp, molasses, caustic and other solutions.

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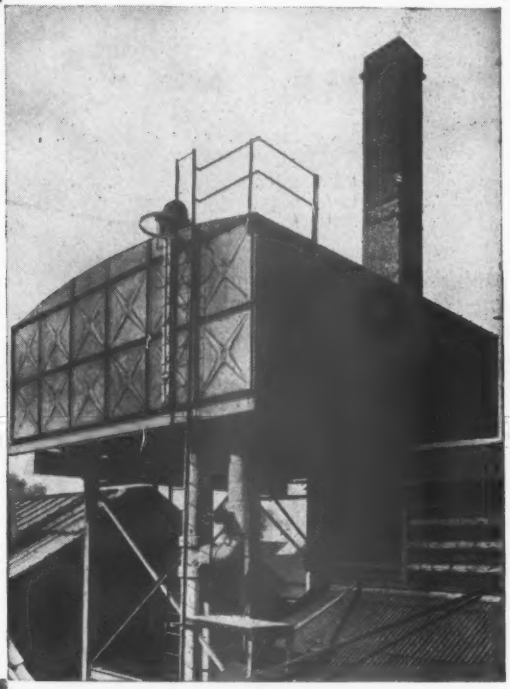

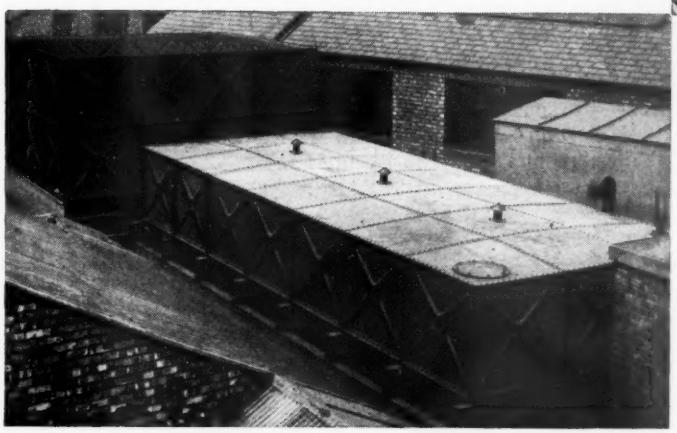

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It never need have happened

WHEN DRAINPIPES GO WRONG, they cause a lot of trouble to a lot of people. Drains are always underneath *something* — under railway lines, under housing estates, under factories or, as in this case, under busy city streets. When drains have to come up — it's chaos, *costly* chaos.

Far better to put down pipes that can't go wrong — to put down salt glazed vitrified clay pipes. That's why, wherever permanency is essential, Architects, Surveyors, Engineers — all specify drains of vitrified clay.

Vitrified clay is the only sewerage material that really resists the action of acids and alkalis in the flow and in the surrounding soil. Vitrified clay pipes are impervious — they are absolutely hard, never corrode, never lose their glassy smoothness. Vitrified clay pipes can — and do — stay down for centuries.

If you never want to have to dig them up again put down Salt Glazed VITRIFIED CLAY pipes and conduits

NATIONAL SALT GLAZED PIPE MANUFACTURERS' ASSOCIATION

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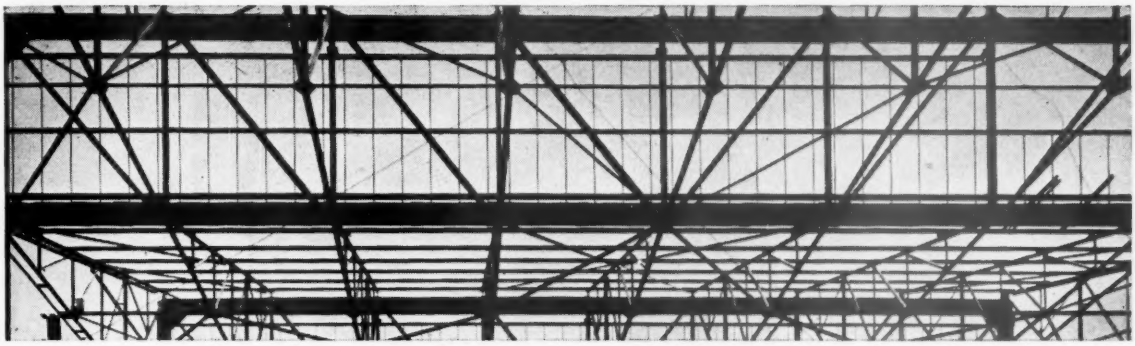
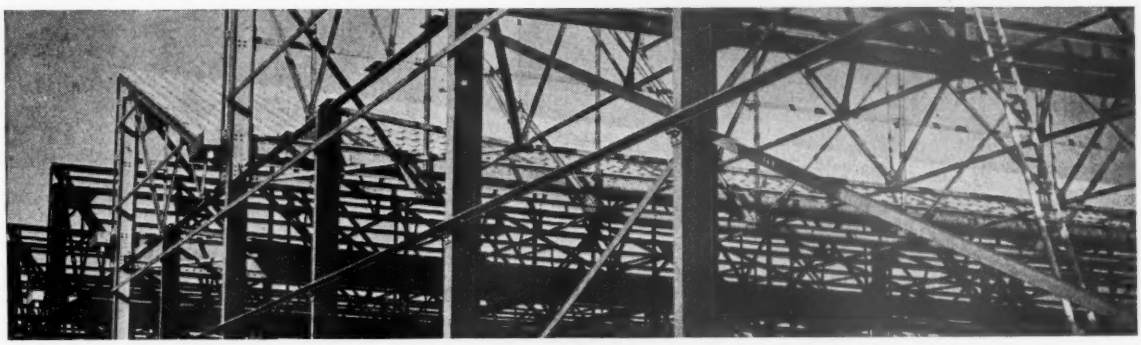


designed, fabricated and erected



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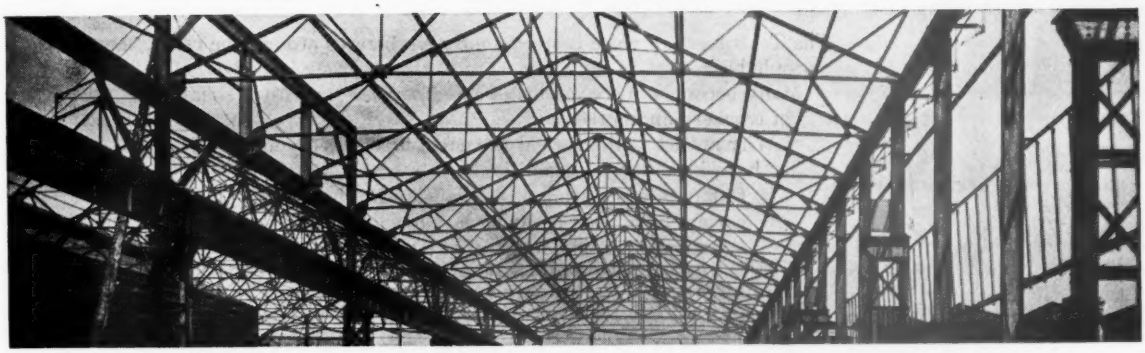

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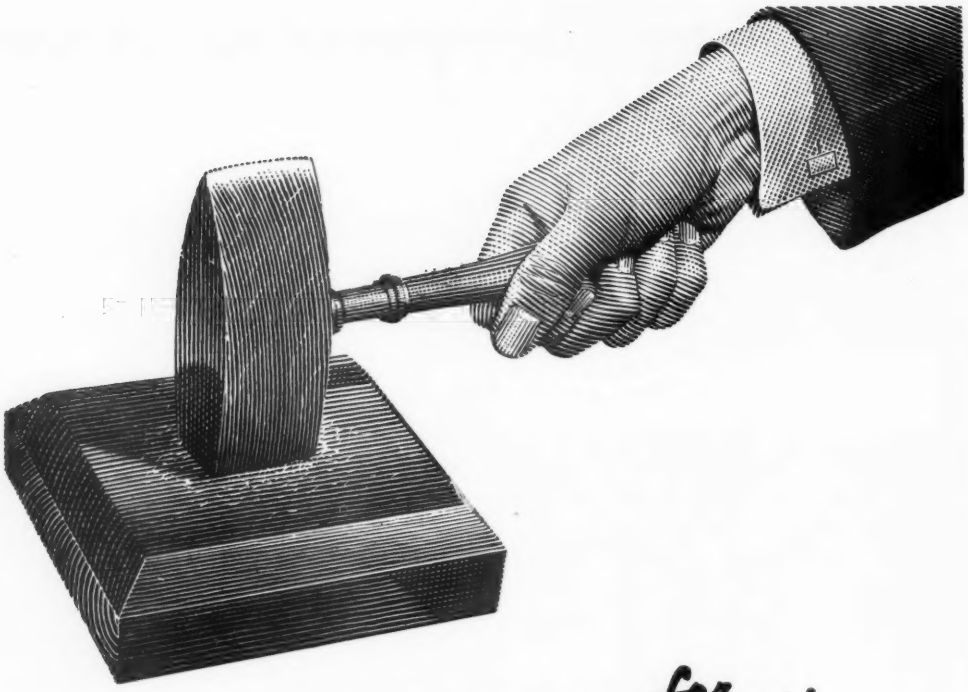

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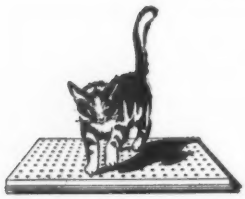

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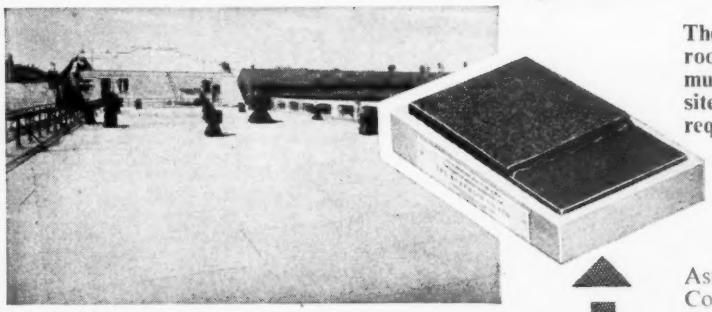

Roof of Marks & Spencer Ltd., Chester.
Architects : Norman Jones, Son & Rigby, Southport.

Joinery Department for W. R. Crow and Son Ltd., London, E.C.1.
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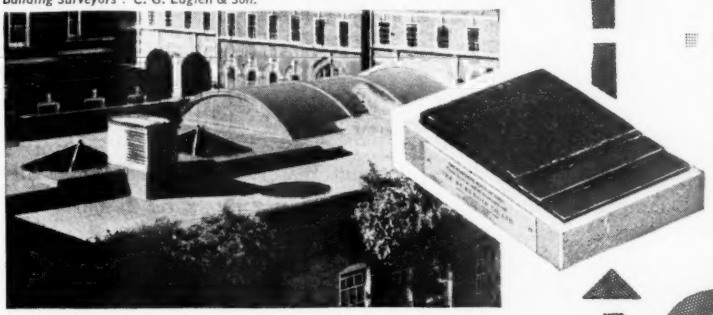

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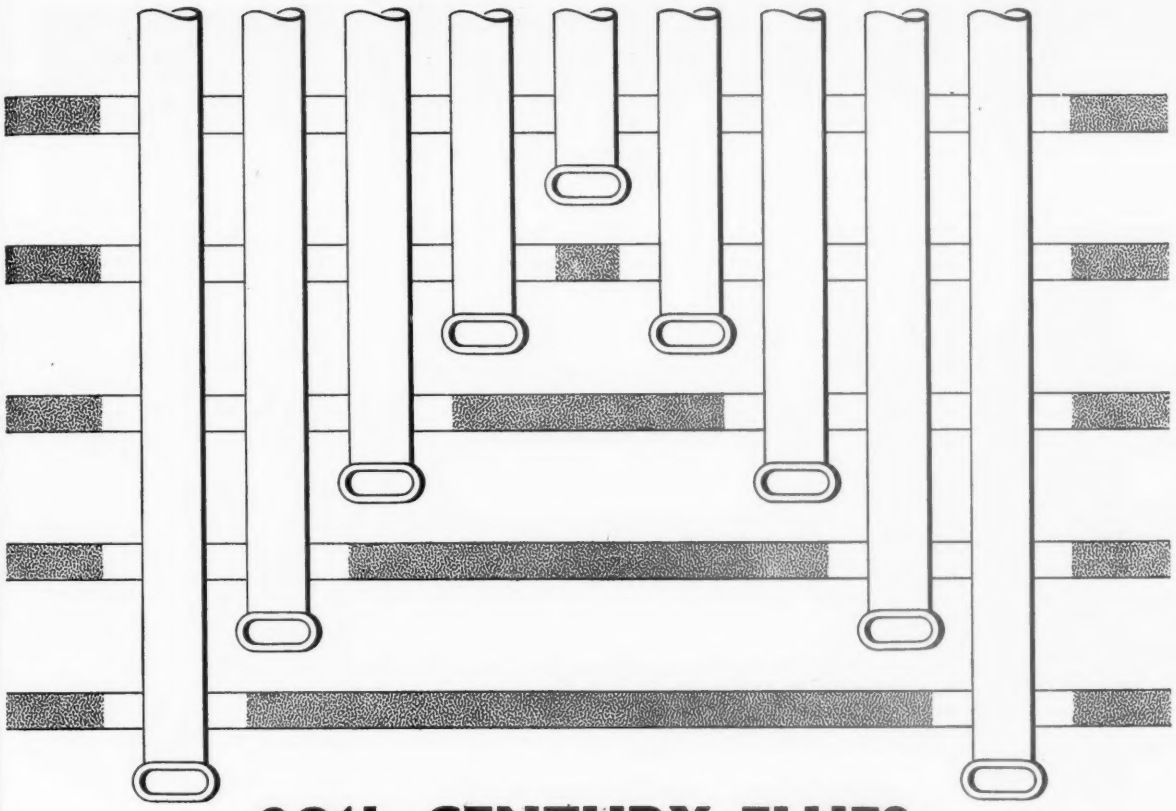

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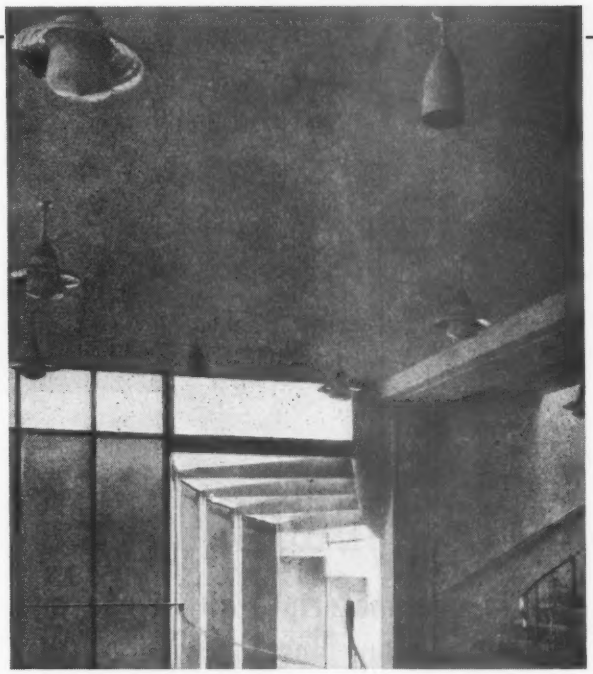

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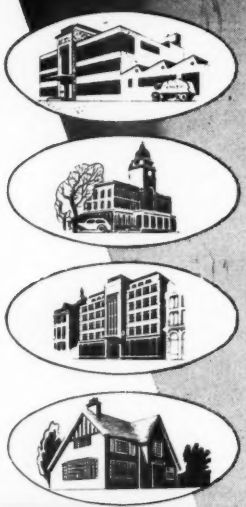

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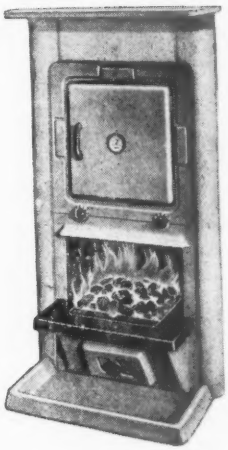

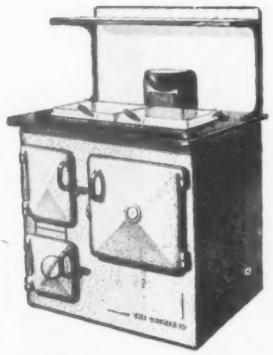

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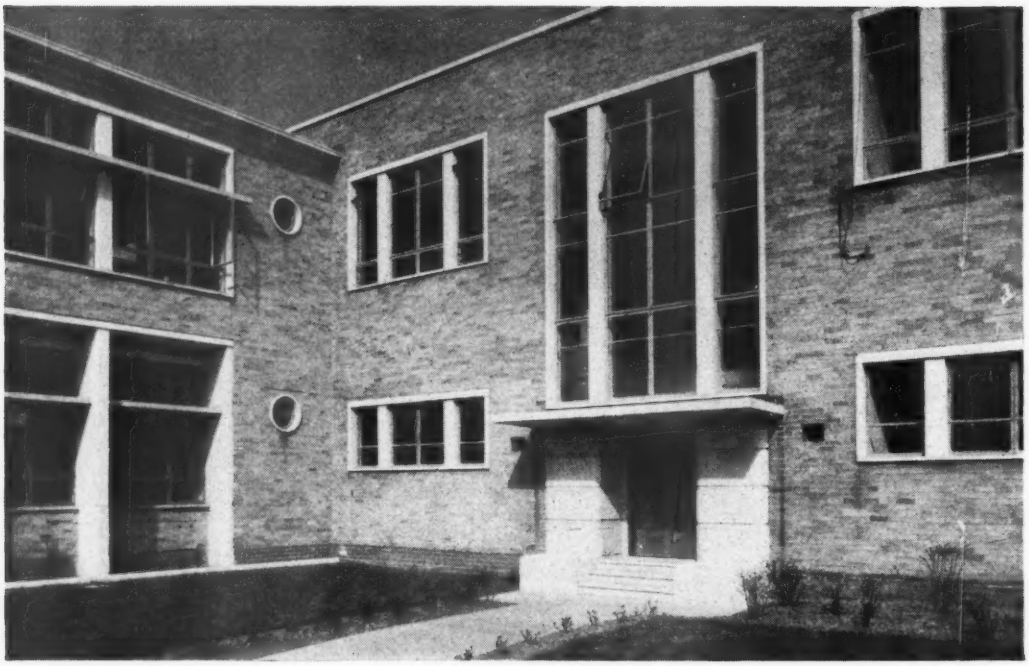

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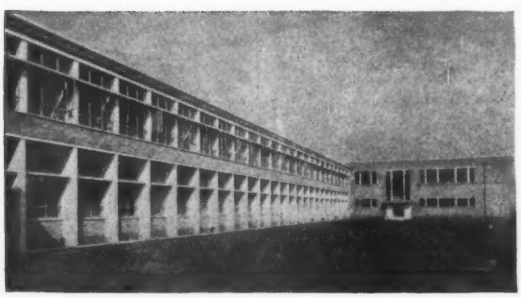

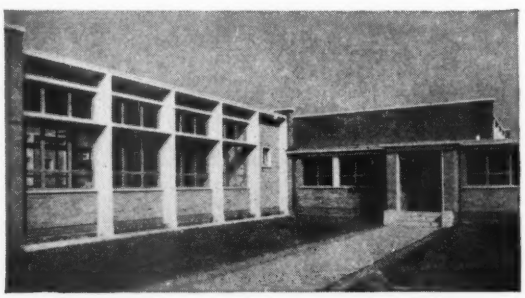

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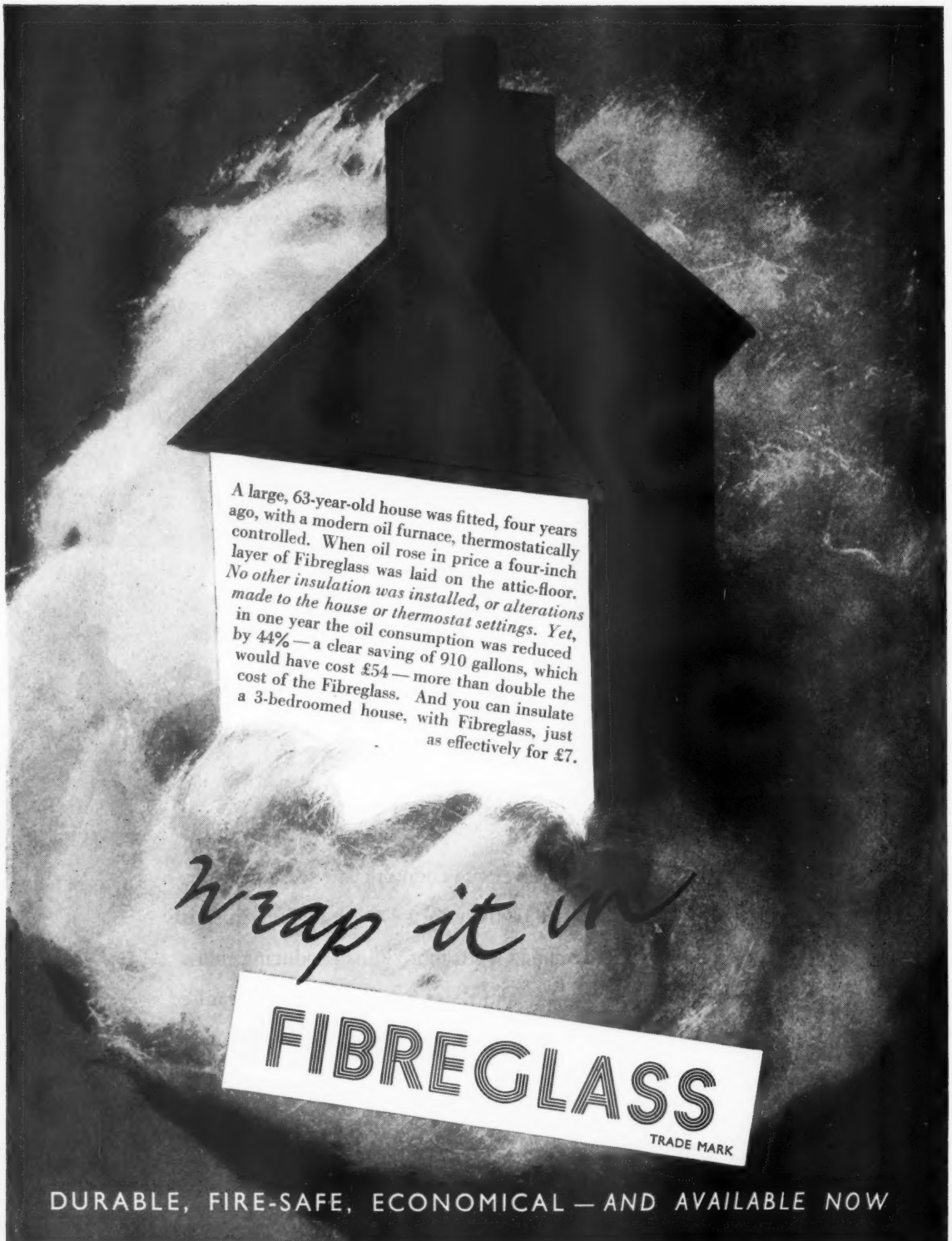
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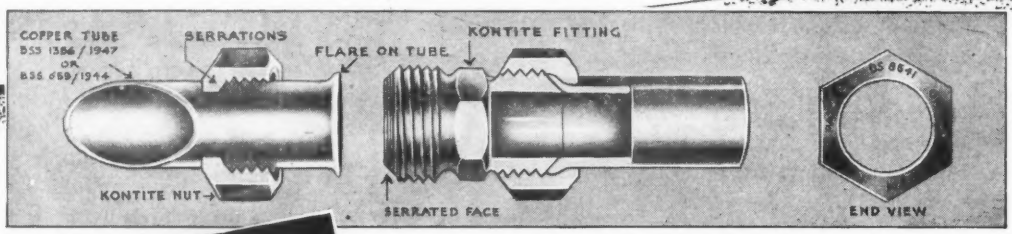

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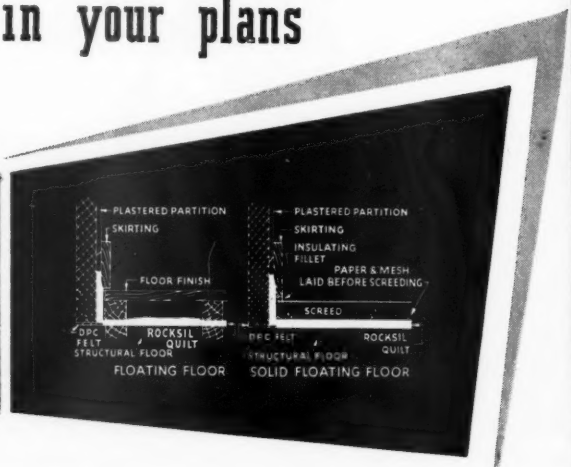

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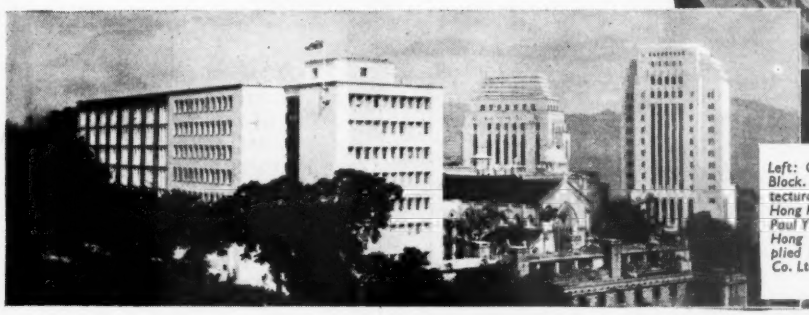

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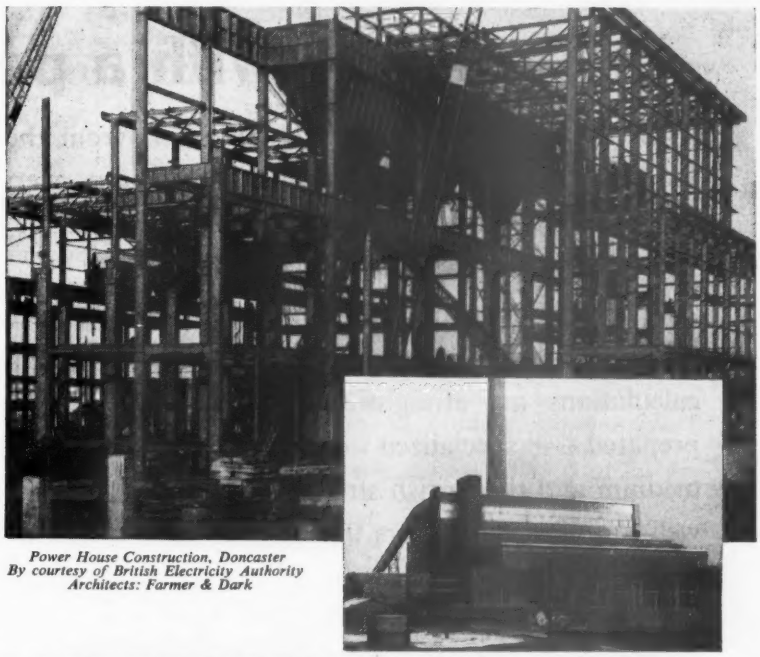

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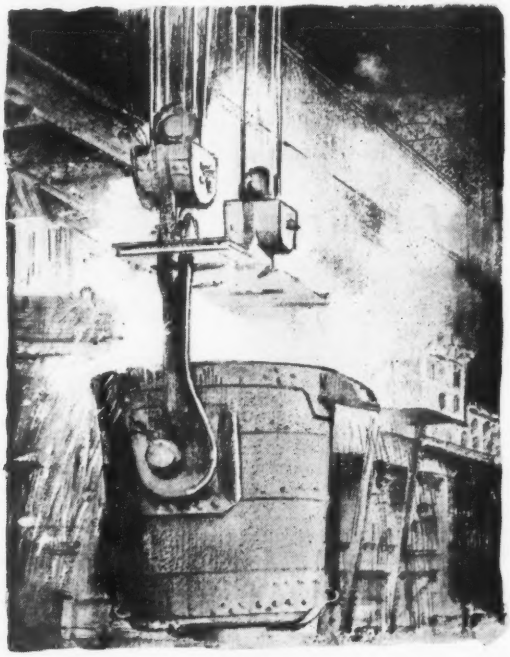

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VOID

Building Research Station Digest
No. 70
OCTOBER, 1954

Some General Principles of the Lighting of Buildings

Introduction

Good lighting is necessary to enable work to be done well and in comfort. A building with bad lighting is an inefficient building, however attractive it may look superficially. It will be judged a bad building by those who have to work in it. The practical result will be that work will be done badly, or slowly, or at the expense of the wellbeing of the occupiers, or all three. The appreciation of lighting depends on sight and intelligence, and the goodness of lighting can be assessed only in relation to what is known of vision and human psychology. Poor lighting can often be combated by good vision and keenness on the work, but at the eventual expense of comfort and efficiency.

The amount of light

The quantity of light necessary for good work depends on the nature of the work, the sharpness of vision, and the environment in which the work is done. The eye has been furnished with the ability to *adapt* itself over a very wide range of conditions. It will achieve enough vision to enable one to get about in starlight, and it will function, although in discomfort, in full sunlight on snow-covered ground. The sunlit snow is more than a *million million* times as bright as the starlit scene. This adaptability is there for emergencies, but it should not be abused.

The minimum amount of light for reading and writing and many manual and domestic tasks is about one foot-candle. This is the light given by one candle one foot away from the work, and is the level of illumination by which most people once did all their reading after darkness had fallen. In those days, however, life went at a more leisurely pace, and there was time to re-read a misread sentence, to correct an error in writing, to pick up a lost stitch. Nowadays work must be done faster and without mistakes. To achieve high visual performance much greater amounts of light are necessary. The Illuminating Engineering Society of Great Britain publishes a Code of Lighting Practice in which all kinds of different visual tasks are listed together with the amount of light which they require for a suitably high standard of visual performance. This standard of performance, 90 per cent of that possible with ideal lighting, has been adopted in Great Britain as a reasonable compromise between efficiency and economy; (to achieve 100 per cent visual performance, levels of the same order as those of natural daylight out of doors are necessary, table 1 gives some examples from the I.E.S. Code. These illuminations are expressed in terms of the unit "lumen per sq. ft" which is exactly the same as the foot-candle. The former unit is now in common use in Great Britain though not in the United States of America. The corresponding metric unit used on the Continent is called the *lux* and is one lumen per sq. metre. 10·764 lux equals one foot-candle or lumen per sq. ft.

All the levels of illumination in the Table are much higher than the one foot-candle of earlier days. Eyesight has not changed, however, and all these tasks, even architectural or engineering drawing, can still be done by the light of a candle, but slowly and inefficiently by present-day standards. The relation between the light required for the same task (a) done easily, and (b) done with great difficulty, has been found from physical work done at the Building Research Station. This shows that about 30 times as much light is required for easy performance as for performance with great difficulty. Thus, a task, such as drawing, which needs 30 foot-candles

TABLE 1

Amount of light for adequate visual performance

(from I.E.S. Code of Lighting)

Visual Task	Level of Illumination
Casual reading	7 lumens per sq. ft
Ordinary bench and machine work	15 " " " "
Carpentry	15 " " " "
Sustained reading	15 " " " "
Sewing	20 " " " "
Typing	20 " " " "
Draughting	30 " " " "
Fine assembly work	50 " " " "

for easy performance, can be done with great difficulty, with one foot-candle.

Daylight and artificial light

The amount of light described in Table 1 has to be provided either by daylight or artificial light, or by a mixture of both. Artificial light is related directly and continuously to the running costs of the building, but daylight is not. This is true only in a broad sense, and ignores such important running expenses as heat loss through windows, but it leads to parsimony in artificial lighting which would not be tolerated if light were free.

The levels of illumination shown in Table 1 must be translated into terms of energy before any practical use can be made of the Table. The amount of lighting energy to be supplied depends on many factors, of which one of the most important is the lightness or dullness of the room surfaces, especially the floor and the ceiling. The same amount of lighting energy whether supplied as daylight or artificial light will go much further in a light-coloured room than in a room with dark decorations.

The efficiency of artificial light depends in the first place on the efficiency of the lamps used, that is, on the amount of light that they give for a given input of energy. Next in importance come the design of the lighting fittings (or "luminaires" as they are now beginning to be called by the lighting profession) and the way in which the luminaires are used (for example, whether they are designed to provide direct or indirect lighting or whether they have a high or low mounting height).

A filament lamp gives about 12 lumens per watt (bigger lamps are more efficient than small lamps) whereas a fluorescent lamp gives three times this amount of light for the same total power expenditure. Direct lighting from reflectors mounted low over the work gives the most illumination for a given expenditure of energy, but such lighting is in many cases thoroughly bad. Good lighting requires a general distribution of light, and this requires a greater consumption of energy for the same amount of light on the work, and so the effective efficiency of filament lighting is in practice only about 5 lumens per watt input. Consequently it is necessary to allow about $\frac{1}{5}$th of a watt per sq. ft for every lumen per sq. ft of maintained illumination of filament lighting, or $\frac{1}{15}$th of a watt per sq. ft for every lumen per sq. ft of maintained illumination of fluorescent lighting; this assumes "average conditions" such as decorations of moderate lightness, luminaires mounted about a third of the way down from the ceiling to the floor, luminaires giving a general distribution of lighting in all directions, etc., etc.

Thus, in order to give a maintained illumination of 15 lumens per sq. ft in, for example, a school classroom of 600 sq. ft floor area, the amount of energy required from filament lamps is given by:

$$600 \times \frac{1}{5} \times 15 \text{ watts} = 1800 \text{ watts}$$

which could be provided, for example, by nine 200 watt or twelve 150 watt units.

The calculation of illumination is of course much more difficult than this in practice. It involves consideration of the dimensions of

TABLE 2

Daylight Factors corresponding to Illumination Levels given in Table 1

Visual Task	Daylight Factor (percentage of outdoor illumination)
Casual reading	1·4 per cent
Ordinary bench and machine work	3 " "
Carpentry	3 " "
Sustained reading	3 " "
Sewing	4 " "
Typing	4 " "
Draughting	6 " "
Fine assembly work	10 " "

the room, the mounting height of the fittings, the directional characteristics of the fittings and so on. It is a specialized job and the example given of the energy required for lighting is only for illustration.

The levels of illumination of Table 1, if they are to be translated in terms of daylight, must be studied to see exactly what they mean. Daylight is variable in amount, it varies from season to season in the temperate zones, and changes with climate and weather as well as with the time of day. To maintain a fixed illumination indoors, therefore, would require windows with adjustable openings; but there is no need for this as the eye can adapt itself readily to slow changes in lighting level on the work when these are accompanied by comparable changes in the surroundings. Visual performance, in fact, although closely related to the level of light on the work, is also influenced by the brightness of the surroundings. Consequently a good estimate of the effectiveness of daylight in a building can be given, within certain strict limits, by the ratio, called the Daylight Factor, of the light inside to the total light available outside.

The values of Table 1 can therefore be expressed as Daylight Factors. Experience has shown that a sound basis for the translation from illumination level to Daylight Factor is to assume a total outdoor daylight level of 500 foot-candles (lumens per sq. ft). There are sound reasons for this which cannot be gone into here, but which will be explained in a later Digest. Thence it follows that necessary Daylight Factor=Prescribed Illumination Level (Table 1)/500. These values, expressed as percentage Daylight Factor, are given in Table 2.

These values of Daylight Factor are based entirely on the question of quantity of light and not quality or comfort. To obtain a Daylight Factor of 10 per cent, for example, demands large windows which must be very carefully placed in relation to the work if intolerable sky glare is not to result on bright days. This will be discussed later.

Lighting the work and the surroundings

The level of light on the work, although the most important feature, is only one of many things that determine good lighting. Good lighting demands that the whole field of vision should be lit in accordance with certain principles.

Local lighting

The eye tends to be attracted to the brighter and more colourful parts of the field of view, and consequently the work or anything that demands special attention should be made particularly bright, or colourful, or both. There should therefore either be preferential direction of light on to the work, or else special local light should be provided. The local illumination should be carefully matched to the needs of the work and also to the level of the general lighting. This is a specialist's job but a guide is given, for example, in the I.E.S. Code. If the local lighting is adequate, the general lighting can often be reduced, but in any case it should never be less than a minimum level of 5 lumens per sq. ft or 1 per cent Daylight Factor in work places.

FIG. 1

Freedom from glare

Turning now to other matters not concerned directly with the amount of light, the most important to be considered is freedom from glare. Glare arises when some parts of the field of vision are excessively bright in relation to the general level of brightness. Glare may reduce the ability to see, for example, when the view of a bright sky prevents clear vision of things below the level of the window sill, or when light from the sky reflected on a bright surface prevents fine detail, such as graduations on a scale, being seen clearly. Such glare disability can be reduced by limiting the amount of light coming to the eye from the glare source, or by making the dark corner brighter by better direction of the light or by brighter decoration.

A typical case of disability resulting from glare is shown in Figure 1 where the reflection of the sky in the brightly polished marking-off table reduces the operator's ability to read his instrument. The glare here is not great enough for him to realize that he is being seriously incapacitated, however. This is the sort of glare situation that must be avoided in a factory. If the glare was worse than it is, the operator would readily appreciate that it is necessary for him to change his position in order to read his scale easily and accurately. But when the glare is not too bad, the operator is often unconscious of it, and the effect of its presence can only be detected by a check on errors or on productivity. In general, however, the effect of glare disability can be recognized fairly readily by inspection.

Glare discomfort however is often present without a degree of glare disability. This is particularly true in very bright surroundings, and was in fact found to be the cause of the poor results which were originally obtained from some of the early American lighting installations designed to provide high levels of illumination. It is now known from the practical experience of factory managers that

FIG. 2

a lighting installation free from glare discomfort is beneficial to the worker.

Glare discomfort is not a fault only of artificial lighting. It can arise from natural lighting when the work bench is wrongly placed in relation to the window. Figure 2 shows an office worker with his desk placed directly in front of a large window open to the bright sky. This position results in a considerable degree of glare discomfort. It is quite common for draughting boards to be placed in such a position because of the benefit which results from the very high level of illumination, but the excessive glare discomfort may very well reduce this benefit. In a properly planned lighting installation it should not be necessary for a worker to wear an eye-shade to reduce the glare discomfort.

In Figure 3 it is seen that, in order to get a satisfactory level of illumination on his work, the operator has brought his office lamp close down towards his desk. In such a position the glare discomfort from the bare bulb hardly two feet from his eyes is considerable. Obviously he has attempted to get the best compromise between the higher level of illumination which the nearness of the lamp to the work gives him and which he needs for his work, and the degree of glare discomfort which results from placing the lamp so near to his eyes. It should not be left to the worker to try to achieve a compromise between sufficient light and freedom from glare discomfort.

To avoid glare discomfort the main essential is to reduce the contrast between the sources of light, whether artificial or natural, and the surroundings. The whole environment should be bright. The sources of light should be limited in brightness and area and should be made to merge into their surroundings. The exact brightness of the light sources must be related to the brightness of the surroundings according to certain rules.

FIG. 3

Generally speaking, the higher the level of illumination, the less is the tolerable ratio between the brightness of the sources and the brightness of the surroundings.

Table 3 gives an indication of the relation between the amount of light provided by the lighting scheme, the brightness and size of of the sources of light that provide it, and their position in the field of view, to ensure acceptable freedom from discomfort from glare. The values of the Table are lower than those given in statutory regulations where the standard of discomfort permitted is necessarily much nearer the tolerable limit.

In rooms where the luminaires are mounted very high out of the line of sight, these limits on the brightness of the sources can be relaxed a little. If the mounting height is more than 8 feet above *customary eye-level*, the values in the Table can be doubled.

Note in particular that the values in the Table do not permit the use of bare fluorescent lamps. The brightness of bare fluorescent lamps (2000 foot-lamberts and more) is well above the acceptable limit if a normal installation giving a satisfactory level of illumination is to be free from glare discomfort. Similarly a large window will almost certainly give glare discomfort in conditions of a bright sky (a bright summer sky has usually a value of about 1500—4000 foot lamberts, well above the limit shown in Table 3). Some means must therefore be provided for reducing the brightness of the window by means for example of a translucent curtain or suitably designed venetian blinds.

The *immediate surroundings to a source* of light produce a marked effect on the degree of discomfort caused by the light source. The brighter these surroundings, the less the glare. The light source designed to give such a gradation of brightness from the bright central portion outwards can have a much higher

TABLE 3

†Task	Average illumn. on the work (lumens·sq. ft)	Brightness of source (foot-lamberts*) when lighting is produced from:		
		Windows or large skylights	Luminaires bigger than 200 sq. in.	Luminaires less than 200 sq. in.
(1)	Under 15	250	500	1000
(2)	15-20	500	1000	1500
(3)	over 50	1000	1500	—

†(1) Casual reading, writing, or sewing, e.g., at home.
(2) Most office or school work, most factory work.
(3) Fine assembly work, toolrooms, drawing offices, etc.

* The *foot-lambert* is a unit of brightness. If one foot-candle (lumen per sq. ft) falls on a perfectly white matt diffusing surface, the surface will have a brightness of one foot-lambert. White paper reflects about 70 to 80 per cent of light, and so 10 foot-candles on white paper result in a brightness of about 7 to 8 foot-lamberts.

average brightness (up to 1½ times) than a source of uniform brightness.

The surroundings

There should be no fixed demarcation between the work and the surroundings. A gradual change in brightness and colour is desirable but this is not always possible in practice. Nevertheless it is often possible to do much by attention to detail. For example, table-tops of moderate lightness are preferable to those that are very dark and highly coloured, because they grade the brightness of white paper more gently into the surroundings.

If the background is not to be obtrusive, care has to be taken to avoid excessive brightness or colour contrast between the different parts of the field of vision. Such excessive contrasts will draw the eyes away from the work and make it difficult to concentrate. There remains plenty of freedom, however, to introduce interest and sparkle into a lighting scheme within the framework of these principles, and it is the job for the good designer to see that the surroundings are stimulating and interesting as well as free from visual discomforts. One way of introducing such stimulation is by the combination of general shadowless lighting with local concentrated beams of light on the work to give hard shadows and sparkling reflections in some parts of the field of view. Care must be taken to ensure that the shadows aid vision and assist modelling, and that the sparkling reflections do not cause distraction or discomfort themselves.

Freedom from colour distortion

Fluorescent lamps can distort colours in a way that can cause comment or concern, much more than filament lamps. This is not because the colour distortion is greater than with filament lamps but because it is different in a way which seems to upset the colour adaptation mechanism of the eye. The colour of the light source itself is no guide to how it will render colours. People vary in their preferences, often illogically. Where colour judgment is important, the type of lamp must be chosen with very special care based on experience and the same type of lamp must always be used for replacements.

Freedom from flicker or stroboscopic effect

Filament lamps operating on alternating current of 50 cycles per second supply cause no visible flicker, but fluorescent lamps can do so because the order of light fluctuation is very much greater. Such flicker can be effectively eliminated by running adjacent lamps in a fitting on special circuits, such as the "lead-lag" inductance and capacitance circuit, or with adjacent lamps in the room wired to the different phases of the three-phase supply. At the moment most "warm" coloured lamps give less flicker than "cold" coloured lamps, but new fluorescent powders may change this situation. At high levels of illumination flicker is more likely to be

troublesome, and special care should therefore be taken. Some people are much more sensitive to flicker than are others and so complaints of flicker should be treated with care and consideration.

Stroboscopic effects may be observed in moving machinery when the illumination is by means of fluorescent lamps. Here again "lead-lag" working or better still three-phase working will go far to eliminate these effects. The problem is however one for the lighting specialist.

Visual rest centres

There is often a need for some negative area in the field of vision to which the gaze can turn when in need of a physical or mental rest. A view through a window often supplies this, even though of itself such a view may be devoid of interest. Not much is known of the factors which determine what is a good visual rest centre, except that it should under no circumstances be bright in relation to the work. The eye should not have to undergo significant changes in its general adaptation level when the gaze wanders away from the work.

Conclusions

To translate these principles into practice demands the skill of a good designer; no rules of thumb will take the place of such skill, but some broad practical conclusions emerge.

(*a*) We see better the more light we have. Adequate visual performance is achieved if about 10 lumens per sq. ft are provided for casual or intermittent tasks, and 50 lumens per sq. ft for difficult and fine work. In terms of daylight, this means a Daylight Factor of 2 per cent for casual work and 10 per cent for fine work, and provision of curtains or blinds to cut out sky glare on bright days.

(*b*) We see better if the main visual task is distinguished from its surroundings by being brighter, or more contrasting, or more colourful, or all three. It is therefore important to identify the main focal points and build up the lighting from their requirements.

(*c*) We see better if the things we have to look at are seen in an unobtrusive and unconfusing setting, neither so bright nor so colourful that it attracts the attention away, nor so dark that work appears excessively bright with the result that the eyes are riveted on to the visual task. Good lighting therefore provides a moderate and comfortable level of general lighting, with preferential lighting on the work. This can be called *focal lighting*.

(*d*) The surroundings should be moderately bright, and this should be achieved by combination of lighting and decoration.

(*e*) No source of light should be a source of glare discomfort. Luminaires should be designed to prevent excessively bright areas being visible. Windows should be provided with curtain blinds or louvres to be brought into use when the sky is very bright.

(*f*) Plenty of light should reach the ceiling, in order to dispel any feeling of gloom, and to reduce glare.

(*g*) Sources of light should be chosen to ensure that the colour rendering which they give is satisfactory for the situation in which they will be found.

(*h*) Care should be taken to eliminate any discomfort from flickering light sources.

(*j*) A dull uniformity should at all costs be avoided. Small brilliant points of light give sparkle to a scene without causing glare.

(*k*) The lighting of a building should be considered always in relation to its design and in particular to the scheme of decoration to be installed. On no account should lighting be considered to be merely a matter of windows or fittings. The whole environment enters into that which constitutes a good lighting installation.

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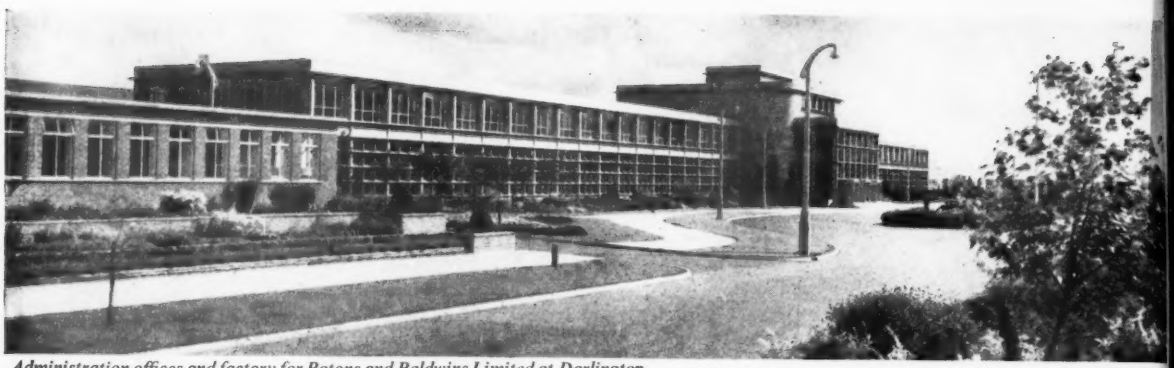

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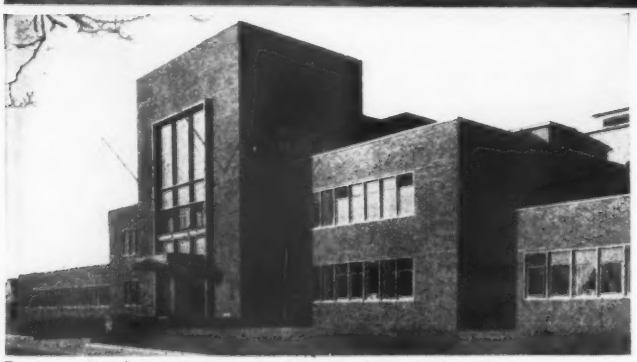

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